



CHEMISTRY

BOOKS - UNIVERSAL BOOK DEPOT 1960 CHEMISTRY (HINGLISH)

CHEMICAL BONDING

Ordinary thinking (Electrovalent bonding)

1. Molecular compounds are usually formed by the combination between :
- A. High ionisation potential and low electron affinity
 - B. Low ionisation potential and high electron affinity
 - C. High ionisation potential and high electron affinity
 - D. Low ionisation potential and low electron affinity

Answer: B



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2. Bond formed in crystal by anion and cation is _____.

- A. ionic
- B. metallic
- C. covalent
- D. dipole

Answer: A

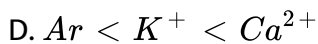
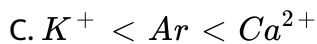


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3. The species Ar , K^+ and Ca^{2+} contain the same number of electrons.

In which order do their radii increase ?

- A. $Ca^{2+} < Ar < K^+$
- B. $Ca^{2+} < K^+ < Ar$

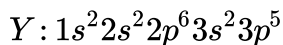
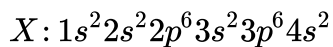


Answer: B

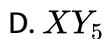
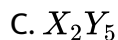
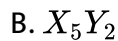


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4. Two elements X and Y have following electronic configurations.



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



Answer: A



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

A. 11

B. 14

C. 16

D. 10

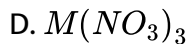
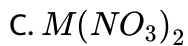
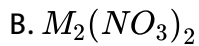
Answer: C



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6. The phosphate of a metal has the formula MPO_4 . The formula of its nitrate will be

A. MNO_3



Answer: D

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7. Crystal structure of NaCl is

A. NaCl molecules

B. Na^+ and Cl^- ions

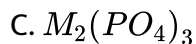
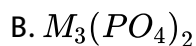
C. Na and Cl atoms

D. None of the above

Answer: B

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8. The sulphate of a metal has the formula $M_2(SO_4)_3$. The formula for its phosphate will be

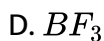
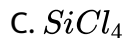
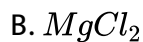


Answer: D



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9. Which of the following is an electrovalent linkage ?



Answer: B

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10. Which of the following is least ionic ?

A. AgCl

B. KCl

C. $BaCl_2$

D. $CaCl_2$

Answer: A

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11. Two elements whose electronegativities are 1.2 and 3.0 the bond formed between them would be

- A. ionic
- B. polar covalent
- C. co-ordinate
- D. metallic

Answer: A

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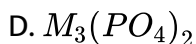
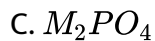
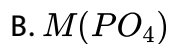
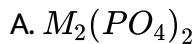
12. Which of the following is an electrovalent linkage ?

- A. CH_3Cl
- B. $NaCl$
- C. CH_4
- D. Cl_2

Answer: B

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13. Formula of a metallic oxide is MO. The formula of its phosphate will be

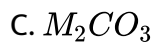
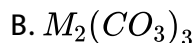


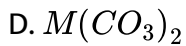
Answer: D



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14. The molecular formula of chloride of a metal M is MCl_3 . The formula of its carbonate would be

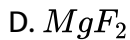
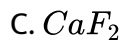




Answer: B

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15. Which of the following is least soluble in water ?



Answer: B

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

- A. oxidized
- B. reduced
- C. hydrolysed
- D. hydrated

Answer: D

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

- A. high M.P. and Low B.P.
- B. High dielectric constant
- C. High M.P. and High B.P.
- D. high polarity

Answer: A

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18. An electrovalent bond is formed between

- A. Good conductor of electricity
- B. Polar in nature
- C. Low M.P. and Low B.P.
- D. Easily available

Answer: B

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19. Solid NaCl is a bad conductor of electricity because

- A. in Solid NaCl there are no ions
- B. Solid NaCl is covalent
- C. In solid NaCl there is no motion of ions

D. In solids NaCl there are no electrons

Answer: C



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20. The strongest bond is

A. Ionic

B. Covalent

C. Hydrogen bond

D. Metallic

Answer: A



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21. The interionic attraction depends on interaction of

- A. solute-solute
- B. solvent-solvent
- C. the charges
- D. molecular properties

Answer: C

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22. Which one is most ionic ?

- A. Cs-Cl
- B. Al-Cl
- C. C-Cl
- D. H-Cl

Answer: A

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23. A compound is formed by the substitution of two chlorine atoms for two hydrogen atoms in propane. Write the structures of the isomers possible.

Give the IUPAC name of the isomer which can exhibit enantiomerism.

A. H-Cl

B. Cl-Cl

C. Na-Cl

D. C-Cl

Answer: C



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24. What is the effect of more electronegative atoms on the strength of an ionic bond ?

- A. Decreases
- B. Increases
- C. Decreases slowly
- D. Remains the same

Answer: B

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25. Which of the following compound contains ionic as well as covalent bonds?

- A. NaCl
- B. $NaClO_4$
- C. PCl_3
- D. $POCl_3$

Answer: B

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26. Out of the following which compound will have electrovalent bonding

A. He

B. CsF

C. NH_3

D. $CHCl_3$

Answer: B

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27. Out of the following which compound will have electrovalent bonding

A. Ammonia

B. Water

C. Calcium chloride

D. Chloromethane

Answer: C



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28. The bonds present in N_2O_4 are

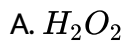
- A. only ionic
- B. only covalent
- C. covalent and coordinate
- D. ionic and coordinate

Answer: C



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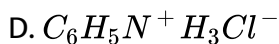
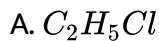
29. Which compound has electrovalent bond



Answer: C

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30. Which of the following is least ionic ?



Answer: A

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31. Ionic compounds do not have

- A. hard and brittle nature
- B. high melting and boiling point
- C. directional properties
- D. soluble in polar solvents

Answer: C



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32. Which one is the strongest bond

- A. Br-F
- B. F-F
- C. Cl-F

D. Br-Cl

Answer: A



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33. Highest melting point would be of

A. He

B. CsCl

C. NH_3

D. $CHCl_3$

Answer: B



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34. Which type of bonding exists in Li_2O and CaF_2 respectively

A. covalent ,covalent

B. Ionic, ionic

C. Ionic, covalent

D. covalent, ionic

Answer: B

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35. Which of the following statements is not true for ionic compounds ?

A. high melting point

B. least lattice energy

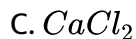
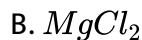
C. least solubility in organic compounds

D. soluble in water

Answer: B

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



Answer: D



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37. Lattice energy of an ionic compound depends upon :

A. charge on the ion only

B. size of the ion only

C. packing of ions only

D. charge on the ion and size of the ion

Answer: D



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38. Which of the following compounds contains ionic bonds?

A. KI

B. CH_4

C. diamonds

D. H_2

Answer: A



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39. The electronic structure of four elements A , B , C , D are

(a) $1s^2$ (b) $1s^2, 2s^2, 2p^2$

(c) $1s^2, 2s^2, 2p^5$ (d) $1s^2, 2s^2, 2p^6$

The tendency to form electrovalent bond is largest in

A. A

B. B

C. C

D. D

Answer: C

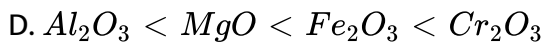
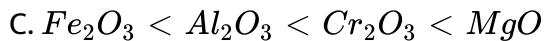


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40. The order of stability of metal oxides is

A. $Cr_2O_3 < MgO < Al_2O_3 < Fe_2O_3$

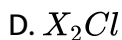
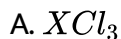
B. $Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$



Answer: B

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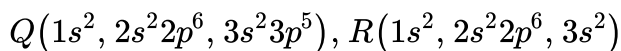
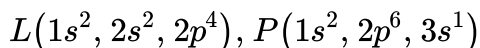
41. An element X with the electronic configuration $1s^2, 2s^2 2p^6, 3s^2$ would be expected to form the chloride with the formula



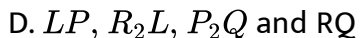
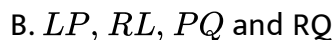
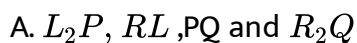
Answer: B

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42. The electronic configuration of four elements L , P , Q and R are given in brackets



The formula of ionic compounds that can be formed between elements are



Answer: C

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43. From the following which group of elements easily forms cation



B. Li,Na,K

C. O,S,Se

D. N,P,As

Answer: B

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44. Chemical formula for calcium pyrophosphate is $Ca_2P_2O_7$. The formula for ferric pyrophosphate will be

A. $Fe_3(P_2O_7)_3$

B. $Fe_4P_4O_{14}$

C. $Fe_4(P_2O_7)_3$

D. Fe_3PO_4

Answer: C

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45. Assertion : Water is a good solvent for ionic compounds but poor one for covalent compounds.

Reason :Hydrogen energy of ions releases sufficient energy to overcome lattice energy and break hydrogen bonds in water, while covalent bonded compound interact so weakly that even van der Waals force between molecule of covalent compounds cannot be broken .

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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46. Assertion: Order of lattice energy for same halides are as $LiX < NaX < KX$.

Reason: Size of alkaline -earth metal increases from Li to K

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: C



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47. Assertion: Born-Haber cycle is based on Hess's law.

Reason: Lattice enthalpy can be calculated by Born-Haber cycle

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: B



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48. Magnesium reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2 2s^2 2p^3$, the simplest formula for this compounds is

- A. Mg_2X_3
- B. MgX_2
- C. Mg_2X

D. Mg_3X_2

Answer: D



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Ordinary thinking (Covalent bonding)

1. Ionic and covalent bonds are present in

A. CCl_4

B. $CaCl_2$

C. NH_4Cl

D. H_2O

Answer: C



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2. The table shown below gives the bond dissociation energies (E_{diss}) for single covalent bonds of carbon (C) atoms with element A,B,C and D.

which element has the smallest atoms

Bond	E_{diss} (kJ mol^{-1})
$C - A$	240
$C - B$	328
$C - C$	276
$C - D$	485

A. A

B. B

C. C

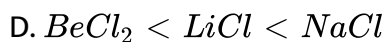
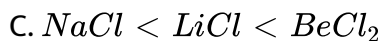
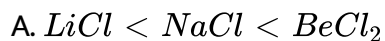
D. D

Answer: D



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



Answer: C



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4. Which one of the electron deficient compounds



Answer: C



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5. Which of the following statements is correct for covalent bonds

A. Electrons are shared between two atoms

B. it may be polar or non-polar

C. Direction is non-polar

D. Valency electrons are attracted

Answer: A::B



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6. The octet rule is not followed in

A. F_2

B. NaF

C. CaF_2

D. BF_3

Answer: D

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7. With which of the given pairs, CO_2 resembles

A. $HgCl_2$, C_2H_2

B. $HgCl_2$, $SnCl_4$

C. C_2H_2 , NO_2

D. N_2O and NO_2

Answer: A

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8. Covalent compounds are generally.....in water

- A. soluble
- B. insoluble
- C. dissociated
- D. hydrolysed

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 point and low boiling points
- D. high melting points and high boiling points

Answer: D



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10. If the atomic number of element X is 7, the best electron dot symbol for the element is _____.

A. X.

B. .X.

C. . $\overset{\cdot}{\underset{\cdot}{\text{X}}}$.

D. : $\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{X}}}$.

Answer: C



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11. Which is the most covalent?

A. C-O

B. C-Br

C. C-S

D. C-F

Answer: C



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12. Strongest bond is

A. C-C

B. C-H

C. C-N

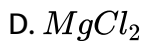
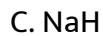
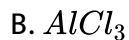
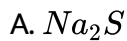
D. C-O

Answer: b



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13. Which of the following has covalent bond



Answer: B



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14. Which type of bond is present in H_2S molecule

A. Ionic bond

B. covalent bond

C. co-ordinate

D. All of three

Answer: B



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15. The major binding force of diamond, silicon and quartz is

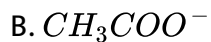
- A. Electrostatic force
- B. Electrical attraction
- C. Covalent bond force
- D. Non-covalent bond force

Answer: C



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16. Among the species CO_2 , CO_3^{2-} , CH_3COO^- , CO, HCHO which has longest carbon-oxygen bond

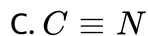


Answer: D



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17. The covalent bond length is the shortest in which of the following bonds



D. $O - H$

Answer: D



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18. The normality of $0.3M$ phosphorous acid H_3PO_3 is:

A. 2

B. 5

C. 4

D. 1

Answer: B



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19. Oxidation number of sulphur in $Na_2S_2O_3$ is

- A. Two
- B. Three
- C. Four
- D. six

Answer: A

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20. Which of the following has a giant covalent structure?

- A. Iodine crystal
- B. Solid CO_2
- C. Silica
- D. White phosphorous

Answer: C

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21. The nature of chemical bonding in graphite is

- A. Covalent
- B. ionic
- C. Metallic
- D. Coordinate

Answer: A



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22. Which of the following atoms has minimum covalent radius

- A. B
- B. C
- C. N

D. Si

Answer: C

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23. Silicon has 4 elements in the outermost orbit. In forming the bonds,

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

Answer: C

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24. Bond energy of covalent $O - H$ bond in water is

- A. Greater than bond energy of H-bonds
- B. Equal to bond energy of H-bonds
- C. Less than bond energy of H-bond
- D. None of these

Answer: A

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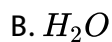
25. Maximum covalent character is associated with the compound

- A. CaF_2
- B. $CaCl_2$
- C. $CaBr_2$
- D. CaI_2

Answer: D

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26. The octet rule is not valid for the molecule .



Answer: C



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27. COVALENT BONDING

A. Germanium

B. Sodium chloride

C. Solid neon

D. Copper

Answer: A



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28. The species CO , CN^- , and NO^+ which are isoelectronic with N_2 , are much more reactive than N_2 because

A. CO

B. N_2^+

C. N_2^-

D. O_2^+

Answer: A



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29. A covalent bond is formed between

- A. Electron nuclear attraction
- B. Electron sharing
- C. Electron transfer
- D. Electrostatic attraction

Answer: B



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30. The electronic configuration of metal M is $1s^2 2s^2 2p^6 3s^1$. The formula of its oxide will be :

- A. MO
- B. M_2O
- C. M_2O_3
- D. MO_2

Answer: B

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31. Which of the following statements regarding covalent bond is not true

- A. The electrons are shared between atoms
- B. the bond is non-directional
- C. the strength of the bond depends upon the extent of overlapping
- D. the bond formed may or may not be polar

Answer: B

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32. VALENCY OF AN ATOM

- A. Combining power of an atom
- B. Atomicity of an element
- C. oxidation number of an element
- D. Charge on an ion

Answer: A

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33. The molecule of sulphuric acid contains

- A. Only covalent bonds
- B. Covalent and ionic bonds
- C. Covalent and co-ordinate bonds
- D. covalent, ionic and co-ordinate bonds

Answer: D

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34. The interatomic distance in H_2 and Cl_2 molecules are 74 and 198 pm respectively. The bond length of HCl is

A. 272 pm

B. 136 pm

C. 124 pm

D. 248 pm

Answer: B



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35. Among the following which property is commonly exhibited by a covalent compound

A. High solubility in water

B. High electrical conductance

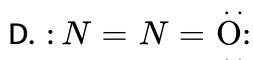
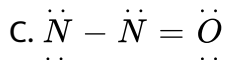
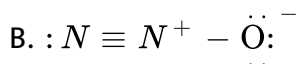
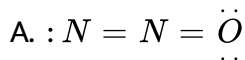
C. Low boiling point

D. High melting point

Answer: C

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36. Which of the following is the correct electron-dot structure of N_2O molecule?



Answer: B

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37. How many electrons pairs are present in valence shell of oxygen in water molecule

A. 4

B. 1

C. 2

D. 3

Answer: A



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38. Boron form covalent compound due to

A. small size

B. higher ionization energy

C. lower ionization energy

D. both (a) and (B)

Answer: D

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39. The following element forms a molecules with eight its own atoms

A. Si

B. S

C. Cl

D. F

Answer: B

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40. Number of electrons in the valence orbit of nitrogen in an ammonia molecule are

A. 8

B. 5

C. 6

D. 7

Answer: A



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41. Covalent compounds have low melting points because

A. covalent bond is less exothermic

B. covalent molecules have definite shape

C. covalent bond is weaker than ionic bond

D. covalent molecules are held by weak Vander waal's force of attraction

Answer: D



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42. Sodium chloride is an ionic compound whereas hydrogen chloride is a gas because

- A. sodium is reactive
- B. covalent bond is weaker than ionic bond
- C. hydrogen chloride is a gas
- D. covalent bond is stronger than ionic bond

Answer: B



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43. Which of the following is not the characteristic of a covalent compound ?

- A. low melting point

B. No definite geometry

C. insoluble in polar solvent

D. small difference in electronegativity between the combining atoms

Answer: B

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44. Among the following groupings, which one represents the set of iso-electronic species

A. NO^+ , C_2^{2-} , O_2^- , CO

B. N_2 , C_2^{2+} , CO , NO

C. CO , NO^+ , CN^- , C_2^{2-}

D. NO , CN^- , N_2 , O_2^-

Answer: C

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45. Among CaH_2 , NH_3 , NaH and B_2H_6 which are covalent hydrides?

A. NH_3 and B_2H_6

B. NaH and CaH_2

C. NaH and NH_3

D. CaH_2 and B_2H_6

Answer: A



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

A. $FeCl_2$

B. $SnCl_2$

C. $AlCl_3$

D. $MgCl_2$

Answer: C

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47. Which of the following substances when dissolved in water will give a solution that does not conduct electricity

A. Hydrogen chloride

B. potassium hydroxide

C. sodium acetate

D. Urea

Answer: D

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

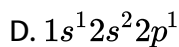
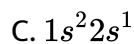
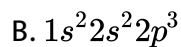
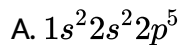
- A. The H-CH-H bond angle in CH_4 , the H-N-H bond angle in NH_3 and the $H - O - H$ bond angle in H_2O are all greater than 90°
- B. The H-O-H bond angle in H_2O is larger than the H-C-H bond angle in CH_4
- C. The H-O-H bond angle in H_2O is smaller than the H-C-N bond angle in NH_3
- D. H-C-H bond angle in CH_4 is larger than the H-N-H bond angle in NH_3

Answer: B



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49. If a molecule X_2 has a triple bond, then X will have the electronic configuration

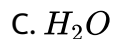


Answer: B



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50. Which of the following compounds does not follow the octet rule the electron distribution



D. PH_3

Answer: A

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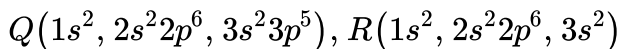
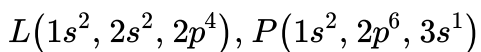
51. Why is H_2S more acidic than water ?

- A. O is more electronegativity than S
- B. O-H bond is stronger than S-H bond
- C. O-H bond is weaker than S-H bond
- D. None of these

Answer: B

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52. The electronic configuration of four elements L , P , Q and R are given in brackets



The formula of ionic compounds that can be formed between elements are

A. Q

B. M

C. R

D. L

Answer: B



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53. Which of the following occurs, when two hydrogen atoms bond with each other

A. Potential energy is lowered

B. Kinetic energy is lowered

C. Electronic motion ceases

D. Energy is absorbed

Answer: A

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54. 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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55. Carbon has a valency of 2 in CO and 4 in CO_2 and CH_4 . Its valency in acetylene (C_2H_2) is

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

Answer: D



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56. Assertion : The atoms in a covalent molecule are said to share electrons, yet some covalent molecule are polar.

Reason : In a polar covalent molecule , the shared electron spend more time on the average near one of the atoms .

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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57. Assertion : Diborane is electron deficient.

Reason: There are no enough valence electrons to form the expected number of covalent bonds.

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

- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A

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58. The bond between two identical nonmetal atoms has a pair of electrons

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false

D. if the assertion and reason both are false

Answer: D

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59. Assertion (A): The fluorine has lower reactivity.

Reason (R): F-F bond has low bond dissociation energy.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if assertion is false but reason in true.

Answer: D

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Ordinary thinking (Coordinate or dative bonding)

1. A coordinate bond is formed when an atom an atom in a molecule has
- A. electric charge on it
 - B. All its valency electrons shared
 - C. A single unshared electrons
 - D. one or more unshared electron pair.

Answer: D



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2. Which one of the following molecules has a coordinate bond



C. $NaCl$

D. Cl_2

Answer: A

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3. Coordinate covalent compounds are formed by

A. Transfer of electrons

B. Sharing of electrons

C. Donation of electrons

D. None of these process

Answer: C

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4. The bond that exists between NH_3 and BF_3 is called

- A. Electrovalent
- B. Covalent
- C. Coordinate
- D. hydrogen

Answer: C



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5. The compound containing coordinate bond is

- A. O_3
- B. SO_3
- C. H_2SO_4
- D. All of these

Answer: D



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6. Sulphuric acid provides a simple example of

- A. co-ordinate bonds
- B. non-covalent compound
- C. covalent and co-ordinate bond
- D. non-covalent ion

Answer: C



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7. $K_4[Fe(CN)_6]$ is a

- A. All ionic

B. All covalent

C. Ionic and covalent

D. Ionic, covalent and coordinate covalent

Answer: D

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8. The compound which contains both covalent and coordinate bond is

A. $BF_3 \cdot NH_3$

B. CH_2Cl_2

C. C_2H_4

D. CH_3NH_2

Answer: A

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9. The number of dative bonds in sulphuric acid molecule is

A. 0

B. 1

C. 2

D. 4

Answer: C



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10. The compound containing coordinate bond is

A. SO_3^{2-}

B. CH_4

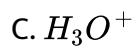
C. CO_2

D. NH_3

Answer: A

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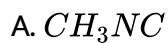
11. The coordinate bond is absent in

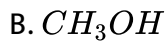


Answer: B

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12. Which of the following contains a coordinate covalent bond?

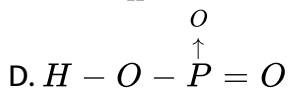
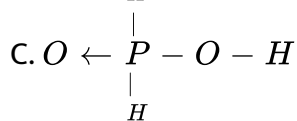
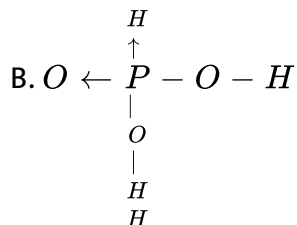
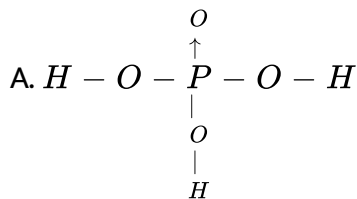




Answer: A

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13. The structure of orthophosphoric acid is



Answer: A

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14. What is the nature of the bond between B and O in $(C_2H_5)_2OBH_3$

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

Answer: B

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15. Which of the following compounds shows ionic, covalent and co-ordinate bonds as well ?

A. Water

B. Ammonia

C. Sodium cyanide

D. potassium bromide

Answer: C



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Ordinary thinking (Dipole moment)

1. Which of the following molecules does not possess a permanent dipole moment

A. H_2S

B. SO_2

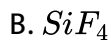
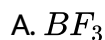
C. CS_2

D. SO_3

Answer: C

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2. Which of the following would have permanent dipole moment ?



Answer: C

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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 directions

B. In NH_3 the atomic dipole and bond dipole are in the opposite directions whereas in NF_3 these are in the same direction

C. In NH_3 as well as in NF_3 the atomic dipole and bond dipole are in the same direction

D. In NH_3 the atomic dipole and bond dipole are in the same direction whereas in NF_3 these are in opposite directions

Answer: D



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

A. SiF_4 and He atoms

B. H_2O and alcohol

C. Cl_2 and CCl_4

D. HCl and He atoms

Answer: D

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

A. NH_3

B. NF_3

C. CO_2

D. CH_4

Answer: A

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6. Which bond angle, θ would result in the maximum dipole moment for the triatomic molecule XY_2 ?

A. $\theta = 90^\circ$

B. $\theta = 120^\circ$

C. $\theta = 150^\circ$

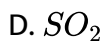
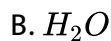
D. $\theta = 180^\circ$

Answer: A



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7. The molecule which has zero dipole moment is



Answer: C

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8. The molecule which has the largest dipole moment amongst the following is

A. HCl

B. HI

C. HBr

D. HF

Answer: D

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9. The dipole moment of chlorobenzene is 1.73 D . The dipole moment of p-dichlorobenzene is expected to be

A. 3.46 D

B. 0.00D

C. 1.73 D

D. 1.00 D

Answer: B

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10. Which of the following has zero dipole moment ?

A. CH_2Cl_2

B. CH_4

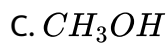
C. NH_3

D. PH_3

Answer: B

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11. Which of the following is the most polar?

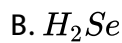


Answer: C



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12. Which of the following is a polar compound ?



D. HI

Answer: A

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13. If the molecule of HCl were totally polar, the observed value of dipole moment is 1.03 D (debye) but the experimental value of dipole moment was 6.12 D. Calculate the percentage ionic character.

A. 17

B. 83

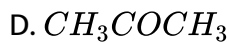
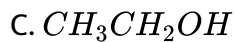
C. 50

D. 90

Answer: A

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14. Which of the following has the least dipole moment?



Answer: A



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15. Which of the following compounds possesses zero dipole moment ?

A. water

B. boron trifluoride

C. benzene

D. carbon tetrachloride

Answer: A



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

:

A. water

B. boron trifluoride

C. benzene

D. carbon tetrachloride

Answer: A



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17. The unequal sharing of bonded pair of electrons between two atoms in a molecule causes _____.

- A. dipole radical formation
- B. covalent bond
- C. decomposition of molecule
- D.

Answer: A

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18. Which of the following has zero dipole moment ?

- A. CCl_4
- B. CH_3Cl
- C. CH_3F
- D. $CHCl_3$

Answer: A

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19. Which of the following fluorides of Xe has zero dipole moment ?



Answer: C



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20. The dipole moment of HBr is $1.6 \times 10^{-30} cm$ and interatomic spacing is 1\AA . The % ionic character of HBr is

A. 7

B. 10

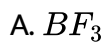
C. 15

D. 27

Answer: B

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21. Which molecules does not show zero dipole moment



Answer: B

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22. Which contains both polar and non-polar bonds ? .

A. Dimethyl sulphoxide

B. Carbon tetrachloride

C. Ammonia

D. Ethyl alcohol

Answer: B

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23. Which of the following molecules will show dipole moment?

A. methane

B. Carbon tetrachloride

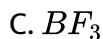
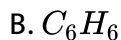
C. chloroform

D. carbon dioxide

Answer: C

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24. Dipole moment is shown by



Answer: D



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25. Fluorine is more electronegative than either boron or phosphorous.

What conclusion can be drawn from the fact that BF_3 has no dipole moment but PF_3 does

A. BF_3 is not spherically symmetrical but PF_3 is symmetrical

B. BF_3 molecule must be linear

C. The atomic radius of F is larger than the atomic radius of B

D. The BF_3 molecule must be planar triangular

Answer: D

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26. Which one of the following is least basic in character?

A. Water

B. ethanol

C. Ethane

D. Ether

Answer: C

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27. In a polar molecule, the ionic charge is 4.8×10^{-10} esu. If the interatomic distance is 1\AA unit, then the dipole moment is

- A. 41.8 debye
- B. 4.18 debye
- C. 4.8 debye
- D. 0.48 debye

Answer: C



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

:

- A. CO_2
- B. BF_3
- C. SO_2

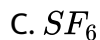
D. Trans-2 -butane

Answer: C



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29. Which of the following is non polar species.

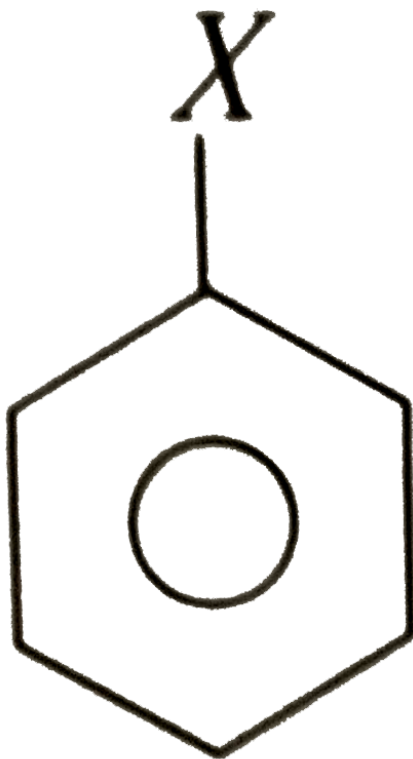


Answer: C

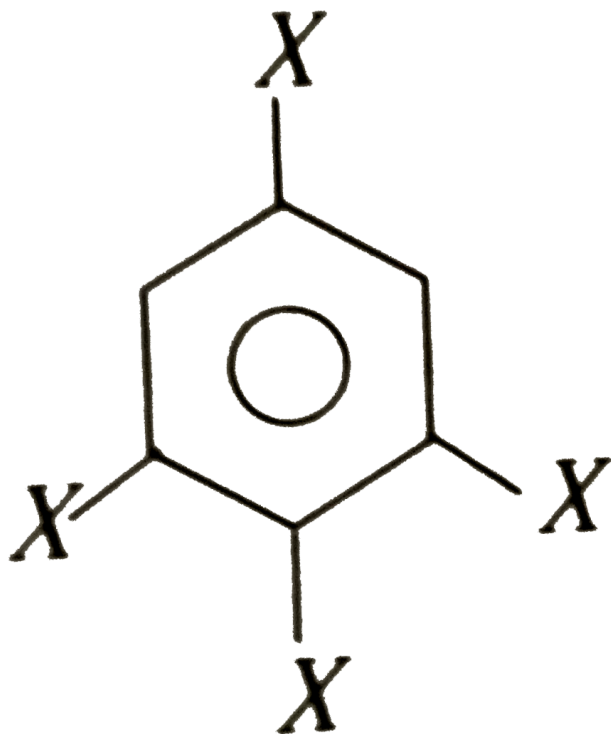


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30. If the dipole moment of the following molecule is 1.5D



Then the dipole moment of the following compound will be



A. 1.5 D

B. 2.25 D

C. 1D

D. 3 D

Answer: A



31. CO is practically non-polar since

- A. The σ -electron drift from C to O is almost nullified by the π - electron drift from O to C
- B. The σ -electron drift from O to C is almost nullified by the π - electron drift from C to O
- C. the bond moment is low
- D. there is a triple bond between C and O

Answer: A



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32. Which molecule has zero dipole moment ?

- A. H_2O

B. AgI

C. $PbSO_4$

D. HBr

Answer: B

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33. N_2 is less reactive than CN^- due to

A. presence of more electrons in orbitals

B. absence of dipole moment

C. difference in spin quantum no

D. none of these

Answer: B

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34. Which is the weakest out of HF, HCl, HBr and HI?

A. H_2

B. HCl

C. HF, HBr

D. HBr

Answer: A



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Ordinary thinking (Polarisation and Fajans rule)

1. 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 bond

C. non-polar bond

D. π bond

Answer: B

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2. Which of the following have both polar and non-polar bonds?

A. C_2H_6

B. NH_4Cl

C. HCl

D. $AlCl_3$

Answer: B

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3. According to Fajan rule, the covalent bond is favoured by :

A. large cation and small anion

B. large cation and large anion

C. small cation and large anion

D. small cation and small anion

Answer: C



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4. Which of the following is a polar compound ?

A. HF

B. HCl

C. HNO_3

D. H_2SO_4

Answer: A



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5. Which of the following possesses highest melting point ?

- A. chlorobenzene
- B. o-dichlorobenzene
- C. m-dichlorobenzene
- D. p-dichlorobenzene

Answer: D



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

- A. C-O

B. C-Br

C. C-S

D. C-F

Answer: D

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7. The ICl molecule is

A. purely electrovalent

B. purely covalent

C. covalent but polar with negative end on iodine

D. covalent but polar with negative end on chlorine

Answer: D

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8. Which of the following is the most polar bond

A. O-H

B. S-H

C. N-H

D. C-H

Answer: A



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9. Dipole moment of HCl = 1.03 D, HI-0.38 D. Bond length of HCl – 1.3 \AA and $HI = 1.6 \text{ \AA}$ The ratio of fraction of electric charge, delta, existing on each atom in HCl and HI is

A. 12: 1

B. 2.7: 1

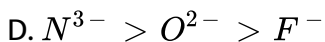
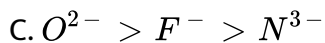
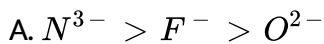
C. 3.3: 1

D. 1: 3.3

Answer: C

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10. The ionic radii of N^{3-} , O^{2-} , F^{-} , Na^{+} follows the order



Answer: D

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11. In which of the following molecules, is the covalent bond most polar ?

A. HI

B. HBr

C. HCl

D. H_2

Answer: C

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12. Which of the following statement is correct

A. SF_4 is polar and non-reactive

B. SF_6 is non-polar and very reactive

C. SF_6 is a strong fluorinating agent

D. SF_4 is prepared by fluorinating SCl_2 with NaF

Answer: B

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13. The bonds between P atoms and Cl atoms in PCl_5 are likely to be

- A. Ionic with no covalent character
- B. covalent with some ionic character
- C. covalent with non ionic character
- D. ionic with some metallic character

Answer: B



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14. Among ClF_3 , BF_3 and NH_3 molecules the one with non-planar geometry is

- A. ClF_3
- B. NH_3
- C. BF_3

D. none of these

Answer: B

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15. Which of the following has zero dipole moment ?

A. ClF

B. PCl_3

C. SiF_4

D. CFCl_3

Answer: C

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16. Maximum covalent character is associated with the compound

A. NaI

B. MgI_2

C. AlCl_3

D. AlI_3

Answer: D

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17. Choose the correct statement

A. Anion polarisation is more pronounced by highly charged cation

B. small cation has minimum capacity to polarise an anion

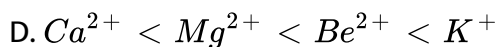
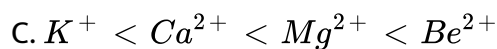
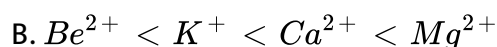
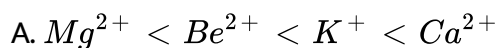
C. small anion has maximum polarizability

D. none of these

Answer: A

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18. 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: C



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19. Two electrons of one atom A and two electrons of another atom B are utilized to form a compound AB. This is an example of

A. polar covalent bond

B. non-polar covalent bond

C. polar bond

D. dative bond

Answer: A

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20. polarisibility of halid ions increasing in the order

A. F^{-} , I^{-} , Br^{-} , Cl^{-}

B. Cl^{-} , Br^{-} , I^{-} , F^{-}

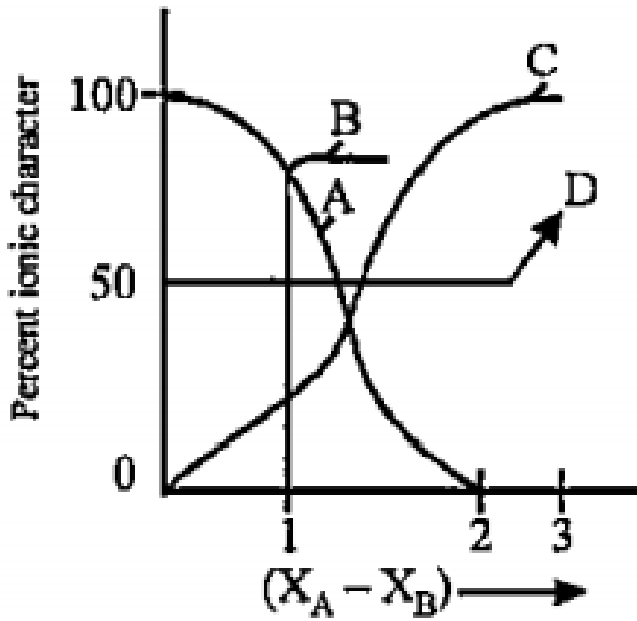
C. I^{-} , Br^{-} , Cl^{-} , F^{-}

D. F^{-} , Cl^{-} , Br^{-} , I^{-}

Answer: D

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21. For AB bond if percent ionic character is plotted against electronegativity difference ($X_A - X_B$), the shape of the curve would look like

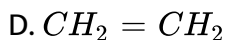
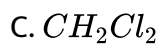
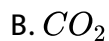


- A. (A)
- B. (B)
- C. (C)
- D. (D)

Answer: C

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22. Planar molecule among the following is



Answer: C

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



D. C-F

Answer: D

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24. Amongst $LiCl$, $RbCl$, $BeCl_2$ and $MgCl_2$, the compounds with the greatest and the least ionic character respectively are :

A. $LiCl$ and $RbCl$

B. $RbCl$ and $BeCl_2$

C. $RbCl$ and $MgCl_2$

D. $MgCl_2$ and $BeCl_2$

Answer: B

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25. Bond polarity of diatomic molecule is because of _____.

- A. Difference in electron affinities of the two atoms
- B. difference in electronegativities of the two atoms
- C. Difference in ionisation potential
- D. All of these

Answer: B



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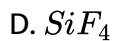
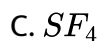
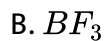
26. Pauling's electronegativity values for elements are useful in predicting

- A. polarity of bonds in molecules
- B. Position of element in electrochemical series
- C. Co-ordination number
- D. Dipole moment of various molecules

Answer: A

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27. Which of the following is a polar molecule



Answer: C

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28. Which of the following has a high polarising power

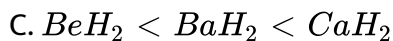
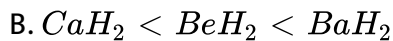
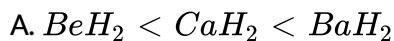




Answer: B

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29. Among CaH_2 , BeH_2 , BaH_2 , the order of ionic character is



Answer: A

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Ordinary thinking (Overlapping σ and π -bonds)

1. Which of the following is not correct

- A. A sigma bond is weaker than π bond
- B. A sigma bond is stronger than π bond
- C. A double bond is stronger than a single bond
- D. A double bond is shorter than a single bond

Answer: A

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2. In which of the following $p\pi - d\pi$ bonding is observed ?

- A. NO_3^-
- B. CO_3^{2-}
- C. BO_3^{-3}



Answer: D



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3. Angular shape of ozone molecule consists of

- A. 1 sigma and 1 pi bonds
- B. 2 sigma and 1 pi bonds
- C. 1 sigma and 2 pi bonds
- D. 2 sigma and 2 pi bonds

Answer: B



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4. In a double bond connecting two atoms there is a sharing of

- A. 2 electrons
- B. 1 electron
- C. 4 electrons
- D. All elements

Answer: C

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5. In which of the following there exists a $p\pi - p\pi$ bonding

- A. Diamond
- B. Graphite
- C. Dimethyl amine
- D. Trisilylamine

Answer: D

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6. Which of the following statement is false

- A. H_2 molecule has one sigma bond
- B. HCl molecule has one sigma bond
- C. water molecule has five sigma bonds and one pi bond
- D. Acetylene molecule has three pi bonds and three sigma bonds

Answer: D



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7. Which type of overlapping results in the formation of a π bonds

- A. Axial overlapping of s-s orbitals
- B. Lateral overlapping of p-p orbitals
- C. Axial overlapping of p-p orbitals

D. Axial overlapping of S-P orbitals

Answer: B



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8. Strongest bond is

A. C-C

B. C=C

C. $C \equiv C$

D. All are equally strong

Answer: C



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9. The number of $(p\pi - d\pi)$ π -bonds present in XeO_3 and XeO_4 respectively are

A. 3,4

B. 4,2

C. 2,3

D. 3,2

Answer: A



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10. The type of bonds present in sulphuric anhydride

A. 3σ and three $p\pi - d\pi$

B. 3σ one $p\pi - p\pi$ and two $p\pi - d\pi$

C. 2σ three $p\pi - d\pi$

D. 2σ and two $p\pi - d\pi$

Answer: B

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11. All the four sigma bonds in perchlorate ion are

A. $sp^3 - sp^3$ bond

B. $sp^3 - p$ bond

C. $sp^3 - sp^2$ bond

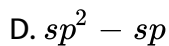
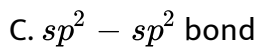
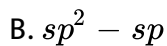
D. $sp^2 - p$ bond

Answer: C

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12. The C-C bond length is shortest in

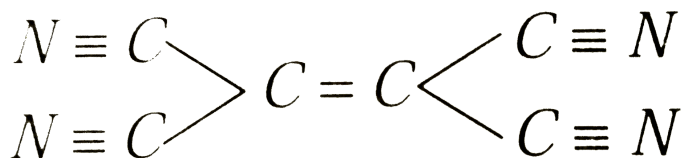
A. $sp - sp$



Answer: A

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13. How many σ and π bonds are in the molecule of tetracyanoethylene



A. Nine σ and nine π

B. five σ and nine π

C. nine σ and seven π

D. five σ and eight π

Answer: A

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14. The bond in the formation of fluorine molecule will be

- A. due to s-s overlapping
- B. due to s-p overlapping
- C. due to p-p overlapping
- D. due to hybridization

Answer: C

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15. Which of the molecule has p-p overlapping ?

- A. hydrogen

B. hydrogen bromide

C. hydrogen chloride

D. chlorine

Answer: D



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16. Assertion(A) - In N_2 molecule, the N atoms are bonded by one sigma and two π -bonds.

Reason(R) :N atoms assume sp^2 hybrid state to constitute N_2 molecule.

A. one σ , two π

B. one σ , one π

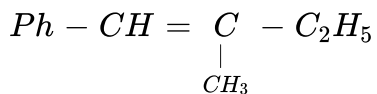
C. two σ , one π

D. three σ bonds

Answer: A

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17. How many σ and π bonds are present in the given compound



- A. 19σ and 4π bonds
- B. 22σ and 4π bonds
- C. 25σ and 4π bonds
- D. 19σ and 4π bonds

Answer: C

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18. The number of σ bonds in P_4O_{10} is

- A. 6
- B. 7

C. 17

D. 16

Answer: D



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19. The bond dissociation energy of $B - F$ in BF_3 is 646 kJ mol^{-1} whereas that of $C - F$ in CF_4 is 515 kJ mol^{-1} . The correct reason for higher $B - F$ bond dissociation energy as compared to that of $C - F$ in CF_4 is

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

B. Stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4

C. Significant $p\pi - d\pi$ interaction between B And F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4

D. Lower degree of $p\pi - d\pi$ interaction between B and F in BF_3 than that between C and F in CF_4

Answer: C

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20. Number of bond in SO_2

- A. two σ and two π
- B. two σ and one π
- C. two σ , two π one lone pair
- D. none of these

Answer: C

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21. In pyrophosphoric acid, $H_4P_2O_7$, number of σ and $d\pi - p\pi$

A. 8 AND 2

B. 6 and 2

C. 12 and zero

D. 12 and 2

Answer: D



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22. Which one of the following molecules contains no π - bond ?

A. NO_2

B. CO_2

C. H_2O

D. SO_2

Answer: C

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23. The outer orbitals of C in ethene molecule can be considered to be hybridized to give three equivalent sp^2 orbitals. The total number of sigma (σ) and pi (π) bonds in ethene molecule is

A. 3 sigma (σ) and 2 pi (π) bonds

B. 4 sigma (σ) and 1 pi (π) bonds

C. 5 sigma (σ) and 1 pi (π) bond

D. 1 σ (sigma) and 2 π (pi) bonds

Answer: C

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24. In the series ethane, ethene and acetylene the $C - H$ bond energy is

A. The same in all the three compound

B. Greatest in ethane

C. Greatest in ethylene

D. Greatest in acetylene

Answer: D

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25. Assertion : σ -bond is strong while π -bond is a weak bond.

Reason : Atomic rotate freely about π -bond.

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

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

C. if assertion is true but reason is false

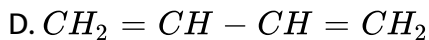
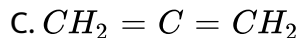
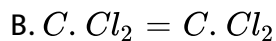
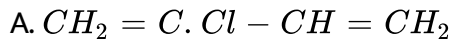
D. if the assertion and reason both are false

Answer: C

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Ordinary thinking (Hybridisation)

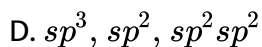
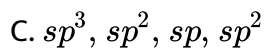
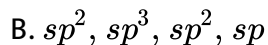
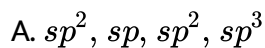
1. Which of the following possesses only sp hybridized carbons?



Answer: C

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2. 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

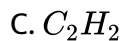


Answer: C



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3. In which one of the following molecules, the central atom said to adopt sp^2 hybridisation ?

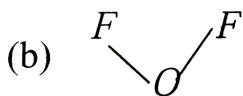
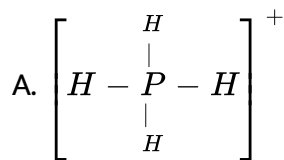


D. NH_3

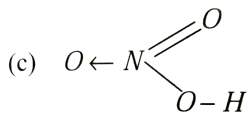
Answer: B

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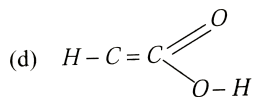
4. Which one of the following formulae does not correctly represent the bonding capacities of the atoms involved ?



B.



C.

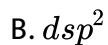


D.

Answer: D

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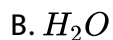
5. Which contains both polar and non-polar bonds?



Answer: A

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6. In which of the following molecule has the maximum bond angle is ?



D. CO_2

Answer: D

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7. The structure and hybridization of $Si(CH_3)_4$ is

A. Bent, sp

B. Trigonal, sp^2

C. Octahedral, sp^3d

D. Tetrahedral, sp^3

Answer: D

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8. In graphite, electrons are

- A. Localised on every third C atoms
- B. present in antibonding orbital
- C. Localised on each C atom
- D. Spread out between the structure

Answer: D

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9. The structure of H_2O_2 is

- A. Planar
- B. Non-planar
- C. Spherical
- D. Linear

Answer: B

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10. In a regular octahedral molecule MX_6 the number of $X - M - X$ bonds at 180° is

- A. Six
- B. Four
- C. Three
- D. Two

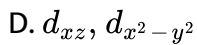
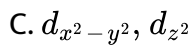
Answer: C



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

- A. d_{x^2} , d_{xz}
- B. d_{xy} , d_{yz}

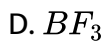


Answer: C



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12. Which of the following molecule has trigonal planar geometry?

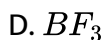
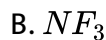
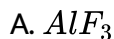


Answer: D



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

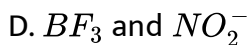
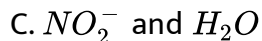
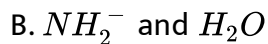
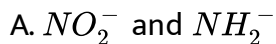


Answer: C



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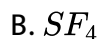
14. In which of the following molecular/ions BF_2 , NO_2^- , NH_2 and H_2O the correct atom is sp^2 hybridized ?



Answer: D

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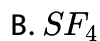
15. In which one of the following species, the central atom has the type of hybridization which is not the same as that present in other three?



Answer: D

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



Answer: B



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17. Some of the properties of the two species, NO_3^- and H_3O^+ are described below. Which one of them is correct?

- A. Dissimilar is hybridization for the central atom with different structures
- B. Isostructural with same hybridization for the central atom
- C. isostructural with different hybridisation for the central atom
- D. similar in hybridization for the central atom with structures

Answer: A

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18. Which of the two ions from the list given have the geometry that is explained by the same hybridization of orbitals

NO_2^- , NO_3^- , NH_2^- , NH_4^+ , SCN^- ?

A. NO_2^- and NH_2^-

B. NO_2^- and NO_3^-

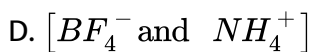
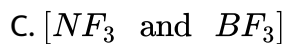
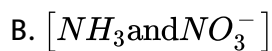
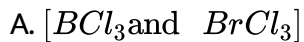
C. NH_4^+ and NO_3^-

D. SCN^- and NH_2^-

Answer: B

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19. Which of the following pairs is isostructural (i.e having the same shape and hybridization ?

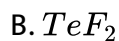


Answer: D



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20. XeF_2 is iso-structural with



Answer: C

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21. Which of the following species has plane trigonal shape ?



Answer: D

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22. Which of the following statement is not correct

- A. Hybridization is the mixing of atomic orbitals prior to their combining into molecular orbitals
- B. sp^2 hybrid orbitals are formed from two p atomic orbitals and one s atomic orbitals
- C. d^2sp^3 hybrid orbitals are directed towards the corners of a regular octahedron
- D. dsp^3 hybrid orbitals are all at 90° to one another

Answer: D

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23. When the hybridization state of a carbon atom changes from sp^3 to sp^2 and finally to sp , the angle between the hybridized orbitals
- A. decreases gradually
- B. increases gradually

C. decreases considerably

D. all of these

Answer: B

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24. in $[Cu(NH_3)_4]SO_4$, Cu has following hybridization

A. dsp^2

B. sp^3

C. sp^2

D. sp^3d^2

Answer: A

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25. The single, double and triple bond lengths of carbon in carbon dioxide are respectively

A. 1.15, 1.22 and 1.10 Å

B. 1.22, 1.15 and 1.10 Å

C. 1.10, 1.15 and 1.22 Å

D. 1.15, 1.10 and 1.22 Å

Answer: B



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26. The smallest bond angle around the central atom will be there in

A. IF_7

B. CH_4

C. BeF_2

D. BF_3

Answer: A

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27. The hybridization of Ag in the linear complex $[Ag(NH_3)_2]^+$ is

A. dsp^2

B. sp

C. sp^2

D. sp^3

Answer: B

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28. In diborane, the H-B-H bond angle is 120° . The hybridization of borons is likely to be

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: B::C



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29. The number of shared pairs of electrons in propane is

A. 2

B. 4

C. 6

D. 10

Answer: D



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30. Which of the following have sp^3 d hybridisation ? .

A. Planar

B. pyramidal

C. angular

D. trigonal bipyramidal

Answer: D



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31. Which of the following hybridisation has maximum s-characters

A. sp^3

B. sp^2

C. sp

D. none of these

Answer: C



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

A. increases

B. decreases

C. becomes zero

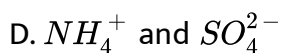
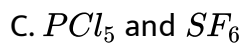
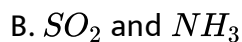
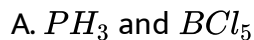
D. does not change

Answer: A



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33. Which of the following pair has same structure but different hybridisation ?

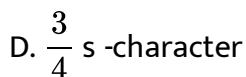
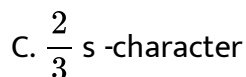
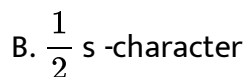
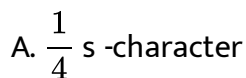


Answer: D



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34. An sp^3 hybrid orbital possesses



Answer: A

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35. Carbon atoms in diamond show

- A. tetrahedral
- B. planar
- C. linear
- D. octahedral

Answer: A

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36. Geometry of ammonia molecule and the hybridisation of nitrogen involved in it are

- A. sp^3 -hybridization and tetrahedral geometry
- B. sp^3 -hybridization and distorted tetrahedral geometry
- C. sp^2 -hybridization and triangular geometry
- D. none of these

Answer: B

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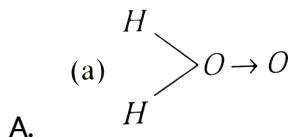
37. In CO_2 , CH_4 and CH_3^+ the hybridisation of carbon atoms are

- A. sp^2 , sp^3 and sp^2 respectively
- B. sp , sp^3 and sp^2 respectively
- C. sp , sp^3 and sp respectively
- D. sp^2 , sp^3 and sp respectively

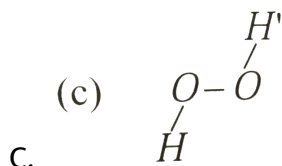
Answer: B

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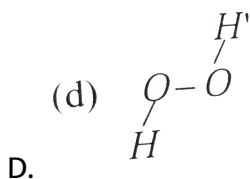
38. The structure of H_2O_2 is



B. H-O-O-H (straight line)



Where $\angle H - O - O = \angle O - O - H' = 101.5^\circ$ and all the four atoms are in the same plane



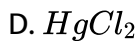
Where $\angle H - O - O = \angle H - O - H' = 97^\circ$ and the angle between H-O-O plane and O-O-H' plane is 101°

Answer: D



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39. Which of the following molecules is not linear?

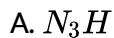


Answer: A



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40. Which of the following is isoelectronic as well as has the same structure as that of N_2O ?



C. NO_2

D. CO_2

Answer: D

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41. What is the geometry of the molecule with sp^3d^2 hybridised central atom is

A. square planar

B. Trigonal bipyramidal

C. octahedral

D. square pyramidal

Answer: C

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42. The structure of PF_5 molecule is _____.

- A. tetrahedral
- B. trigonal bipyramidal
- C. square planar
- D. pentagonal bipyramidal

Answer: B



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43. The structure of IF_7 is

- A. Octahedral
- B. Pentagonal bipyramidal
- C. trigonal bipyramidal
- D. Tetrahedral

Answer: B

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44. The molecule of CO_2 has 180° bond angle it one be explained on the basic of

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

Answer: C

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45. The hydrogen bond is the strongest in

A. HF

B. HI

C. CH_4

D. PH_3

Answer: A



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

A. BF_3 and NCl_3

B. H_2S and $BeCl_2$

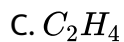
C. BF_3 , NCl_3 and H_2S

D. NCl_3 and H_2S

Answer: D

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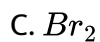
47. Which of the following molecule is planar?



Answer: C

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48. The bond enthalpy is highest for:



D. H_2

Answer: D

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49. All carbon atoms are sp^2 -hybridised in:

A. 1,3-butadiene

B. $CH_2 = C = CH_2$

C. Cyclohexane

D. 2-butene

Answer: A

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50. The incorrectly matched pair, among the following is

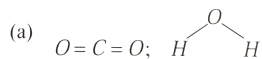
- | | | |
|----|-----------|----------------------|
| A. | Molecules | Shape |
| | BrF_5 | Trigonal bipyramidal |
| B. | Molecules | Shape |
| | SF_4 | See Saw |
| C. | Molecules | Shape |
| | ClF_3 | T-shape |
| D. | Molecules | Shape |
| | NH_4^+ | Tetrahedral |

Answer: A

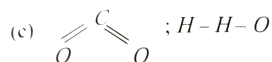
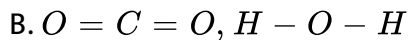
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51. Experiment shows that H_2O has a dipole moment while CO_2 has not .

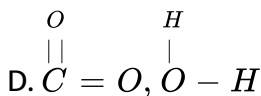
Point out the structure which best illustrate these facts



A.



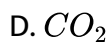
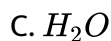
C.



Answer: A

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



Answer: D

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53. Explain hybridisation in XeF_2 . Also draw its molecular structure.

A. sp^3

B. sp^3d

C. sp^3d^2

D. none of these

Answer: B



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54. As the p - character increases the bond angle in in hybrid orbital formed by a and atomic orbitals

A. decreases

B. increases

C. doubles

D. remains unchanged

Answer: A

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55. Which of the following molecule/molecules have zero dipole moment?

NH_3 , H_2O , CO_2 , CBr_4 , $CHBr_3$, BCl_3 , $BeCl_2$

A. sp^2 , sp^3 and sp

B. sp , sp^2 and sp^3

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

D. sp^2 , sp and sp^3

Answer: B

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56. Which of the following having plane of symmetry ?

A. H_2SO_4

B. H_2O

C. HNO_3

D. CCl_4

Answer: C

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57. Which of the following statements is true for ammonium ion

A. All bonds are ionic

B. All bonds are coordinate covalent

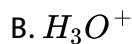
C. H atoms are situated at the corners of a square

D. H atoms are situated at the corners of a tetrahedron

Answer: D

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58. Which of the following is a planar molecule ?

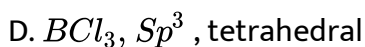
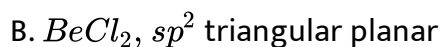
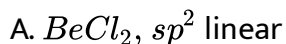


Answer: C



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



Answer: C



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60. In which of the following molecule in the bond angle is maximum ?

A. 120°

B. 180°

C. $109^\circ 28'$

D. $104^\circ 30'$

Answer: D



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61. In ethene, the bond angles are exactly

A. $109^\circ 28'$

B. 120°

C. 180°

D. different

Answer: B



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62. Which molecules has zero dipole moment ?

A. CH_4

B. C_2H_6

C. NH_3

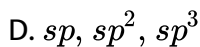
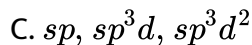
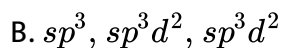
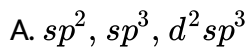
D. C_6H_6

Answer: D



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63. What is the correct mode of hybridization of the central atom in the following compounds. NO_2^+ , SF_4 , PF_6^-

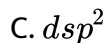
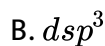
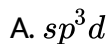


Answer: C



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64. Which of the following species has square planar geometry ?

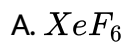


Answer: C



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65. Which of the following compounds has square pyramidal geometry ?

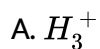


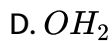
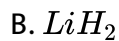
Answer: C



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

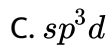
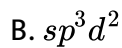
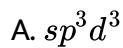




Answer: B

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67. What is the oxidation number of Xe in $XeOF_2$?



Answer: C

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68. sp^2 -hybridisation is involved in the molecule of

- A. pyramidal
- B. tetrahedral
- C. octahedral
- D. trigonal planar

Answer: D

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69. Out of the following hybrid orbitals, the one which forms the bond at angle 120° , is

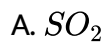
- A. $d^2 sp^3$
- B. sp^3
- C. sp^2
- D. sp

Answer: C



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70. Which of the following molecule is linear?



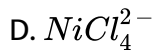
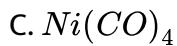
Answer: B



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71. Which of the following is not tetrahedral ?

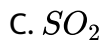
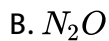




Answer: A

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72. Which one of the following compounds has sp^2 hybridisation ? .



Answer: C

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73. $HgCl_2$ is a solid containing

- A. An angular Cl-Hg-Cl molecule
- B. A linear Cl-Hg-Cl molecule
- C. A T-shaped Cl-Hg-Cl molecule
- D. A pyramidal Cl-Hg-Cl molecule

Answer: B



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74. Hybridisation shown by N in HNO_3 is

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

Answer: A

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75. State of hybridization of carbon atoms in vinyl acetylene is/are

A. sp^2

B. sp

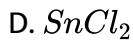
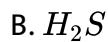
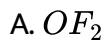
C. sp^2 and sp

D. sp^3 , sp^2 and sp

Answer: C

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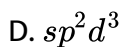
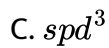
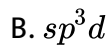
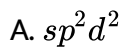
76. In which of the following pairs of molecule/ions , the central atom has sp^2 hybridization?



Answer: D

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77. The PCl_5 molecule is a result of the hybridisation of



Answer: B

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78. Which one is false in the following statements

- A. Each carbon in ethylene is in sp^2 hybridisation
- B. Each carbon in acetylene is in sp^3 hybridisation
- C. Each carbon in benzene is in sp^2 hybridisation
- D. Each carbon in ethane is in sp^3 hybridisation

Answer: B



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79. Which of the following will be octahedral ?

- A. SF_6
- B. BF_4^-
- C. PCl_5



Answer: A



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80. The length of C-C bonds in benzene is

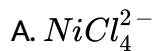
- A. Tautomerism
- B. sp^2 hybridisation
- C. Isomerism
- D. Inductive effect

Answer: B



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81. Which of the following does not involve dsp^2 -hybridisation and are square planar ?



Answer: D



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82. Match List I with List II. Select the correct answer using the codes given below the list

List I		List II	
(Molecule/ion)		(Type of hybridization)	
(A)	NH_4^+	1.	$sp^3 d^3$
(B)	PCl_5	2.	$sp^3 d$
(C)	SF_6	3.	sp^3
(D)	IF_7	4.	$sp^3 d^2$

Answer the code

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

Answer: A



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83. The correct order towards bond angle is

A. $sp < sp^2 < sp^3$

B. $sp^2 < sp < sp^3$

C. $sp^3 < sp^2 < sp$

D. Bond angle does not depend on hybridisation

Answer: C

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84. Bond angle in PH_3 is

A. Much less than NH_3

B. Equal to that of NH_3

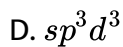
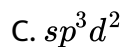
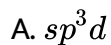
C. Much greater than NH_3

D. Slightly greater than NH_3

Answer: A

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85. The hybridisation present in IF_3 is

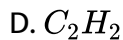
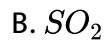


Answer: A



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86. Which of the following compounds doesn't have linear structure

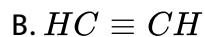
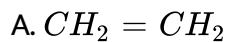


Answer: B



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87. Which compound does not possess linear geometry

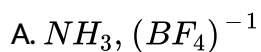


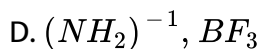
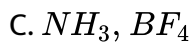
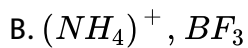
Answer: A



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88. In which of the following pairs, bond angle is $109^\circ 28'$?

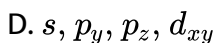
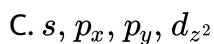
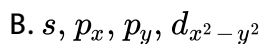
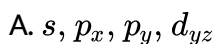




Answer: A

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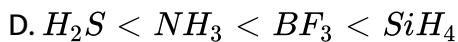
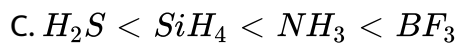
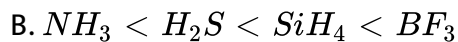
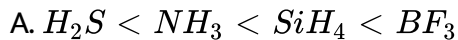
89. A square planar complex is formed by hybridisation of which atomic orbitals?



Answer: B

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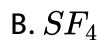
90. The correct order of decreasing bond angles in H_2S , NH_3 , BF_3 and SiH_4 is

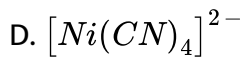


Answer: A

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91. Which of the following has the regular tetrahedral structure?

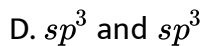
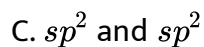
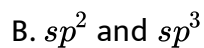
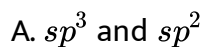




Answer: A

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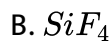
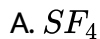
92. The states of hybridisation of boron and oxygen atoms in boric acid (H_3BO_3) are respectively :



Answer: B

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

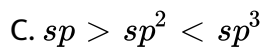
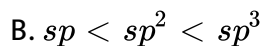
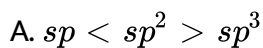


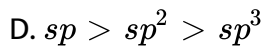
Answer: A



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



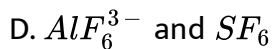
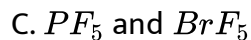
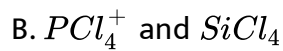
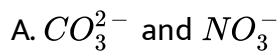


Answer: D



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

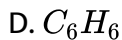
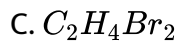
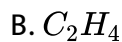
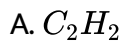


Answer: C



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96. The C-H bond distance is the longest in:

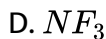
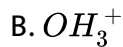
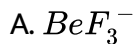


Answer: C



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97. In which of the following the central atom does not use sp^3 hybrid orbitals in its bonding



Answer: A

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98. In the complex $[SbF_5]^{2-}$, sp^3d hybridization is present. Geometry of the complex is

- A. square
- B. Square pyramidal
- C. Square bipyramidal
- D. Tetrahedral

Answer: B

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99. Bond angle is minimum for

- A. H_2Te
- B. H_2Se

C. H_2O

D. H_2S

Answer: A

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100. Be in $BeCl_2$ undergoes

A. Linear hybridization

B. Trigonal hybridization

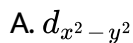
C. Tetrahedral hybridization

D. No hybridization

Answer: A

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101. The d-orbitals involved in sp^3d hybridisation is:

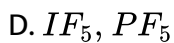
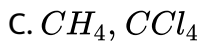
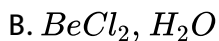
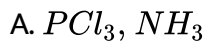


Answer: C



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102. The pair having similar geometry is



Answer: A::C

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103. The shape of the ammonia molecule is

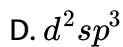
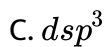
- A. tetrahedral
- B. Trigonal pyramid
- C. trigonal bipyramidal
- D. trigonal planar

Answer: B

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104. The hybridization in PF_3 is

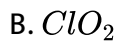
- A. sp^3



Answer: A

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105. Which of the following is not linear ?

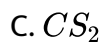
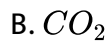


D. None of these

Answer: B

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106. Which of the following is non-linear molecule

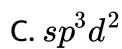
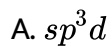


Answer: A



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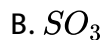
107. The hybrid state of sulphur in SO_3 molecule is



Answer: D

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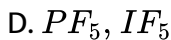
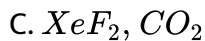
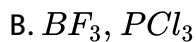
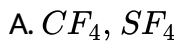
108. The molecule which has pyramidal shapes is:



Answer: A

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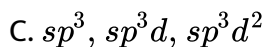
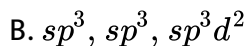
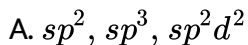
109. The pair of species having identical shapes for molecules of both species is



Answer: C

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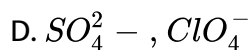
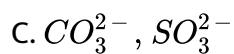
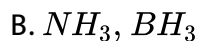
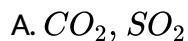
110. SF_2, SF_4 and SF_6 have the hybridisation at sulphur atom respectively as .



Answer: C

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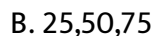
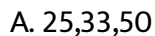
111. In which pair of species both species do have the similar geometry ? .



Answer: D

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112. The percentage s-character of the hybrid orbitals in methane , ethene are respectively



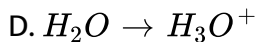
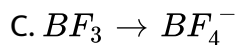
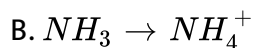
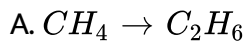
C. 50,75,100

D. 10,20,40

Answer: A

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113. Which of the following conversion involves change in both hybridization and shape ?



Answer: C

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114. The percentage of p character of hybrid orbitals in graphite and diamond are respectively

A. 33 and 25

B. 50 and 75

C. 67 and 75

D. 33 and 75

Answer: C



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

A. sp , 0

B. sp^2 , 0

C. sp^3 , 0

D. dsp^2 , 1

Answer: C



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116. Hybridisation of central atom in NF_3 is

A. sp^3

B. sp

C. sp^2

D. dsp^2

Answer: A



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117. Explain why all bonds in SF_4 molecule are not equivalent.

A. 89° , 117°

B. 120° , 180°

C. 45° , 118°

D. 117° , 92°

Answer: A



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118. Pentagonal bipyramidal structure contains bond angles approximately.

A. 120° , 90° , 180°

B. 120° , 72° , 180°

C. 72° , 90° , 120°

D. 72° , 90° , 180°

Answer: D

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119. a completely filled d orbital (d^{10})

- A. Spherically symmetrical
- B. Has octahedral symmetrical
- C. Has octahedral symmetry
- D. Depends on the atom

Answer: B

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120. Which of the following has sp^3 hybridisation of central atom ?

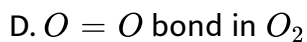
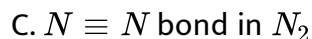
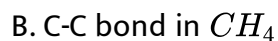
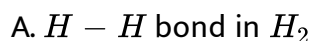
- A. PCl_3
- B. SO_3
- C. BF_3



Answer: A

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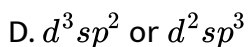
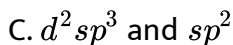
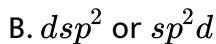
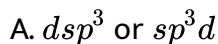
121. Which of the following bonds require the largest amount of bond energy to dissociate the atoms concerned ?



Answer: C

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122. The trigonal bipyramidal geometry results from the hybridisation

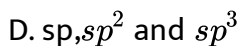
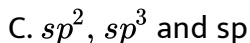
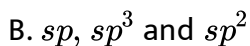
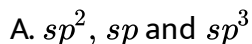


Answer: A



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123. The hybridization of atomic orbitals of nitrogen in NO_2^+ , NO_3^- , and NH_4^+ respectively are



Answer: D



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124. Identify the incorrect statements, regarding the molecule XeO_4

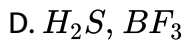
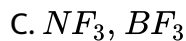
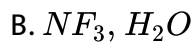
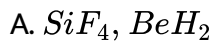
- A. XeO_4 molecule is square planar
- B. There are four $p\pi - d\pi$ bonds
- C. There are four sp^3 - p, σ bonds
- D. XeO_4 molecule is tetrahedral

Answer: A



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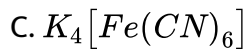
125. In which of the following species the underlined C atom has sp^3 hybridization?



Answer: B

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126. Which of the following has tetrahedral structure



D. None of these

Answer: B

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127. The electronic structure of molecule OF_2 is a hybrid of

A. sp

B. sp^2

C. sp^3

D. sd^3

Answer: C



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128. $CH_2Cl - CHCl_2$

A. sp

B. sp^2

C. sp^3

D. sp^2d

Answer: C



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129. As compared to pure atomic orbitals, hybrid orbitals have

- A. Low energy
- B. Same energy
- C. High energy
- D. None of these

Answer: A



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130. The valency of carbon is four. On what principle it can be explained in a better way

- A. Resonance
- B. Hybridization
- C. Electron transfer
- D. None of the above

Answer: B



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131. A) C-H bond in ethyne is shorter than C-H bonds in ethene.

R) Carbon atom in ethene is sp -hybridised while it is sp^2 in ethyne.

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

- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: C

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132. Assertion : Bond order can assume any value number including zero.

Reason : Higher the bond order ,shorter is bond length and greater is bond energy.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false

D. if the assertion and reason both are false

Answer: B

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133. The species, having bonds angle of 120° is

A. CF_3

B. NCl_3

C. BCl_3

D. PH_3

Answer: C

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Ordinary thinking (Resonance)

1. Which molecule does not show resonance

- A. Benzene
- B. Aniline
- C. Ethyl amine
- D. Toluene

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. $-0.75, 1.25$
- B. $-0.75, 1.0$
- C. $-0.75, 0.6$
- D. $-3, 1.25$

Answer: A



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3. Explain the important aspects of resonance with reference to the CO_3^{2-} ion.

A. 2

B. 3

C. 6

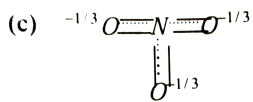
D. 9

Answer: B

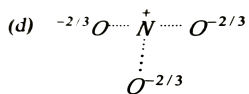


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4. Point out incorrect statement about resonance



C.



D.

Answer: C

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6. The bond order in CO_2^{2-} ion between C - O is

A. Zero

B. 0.88

C. 1.33

D. 2

Answer: C

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7. Resonance is due to

- A. Delocalization of sigma electrons
- B. Delocalization of pi electrons
- C. Migration of H atoms
- D. Migration of protons

Answer: B



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8. Select the incorrect statement about the following :

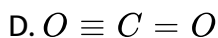
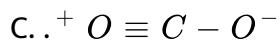
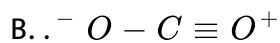
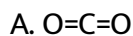
- A. O_3 is used as germicide for purification of air
- B. In O_3 , $O - O$ bond length is identical with that of molecular oxygen
- C. O_3 molecule is angular in shape

D. O_3 is an oxidizing agent

Answer: B

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9. Which one in the following is not the resonance structure of CO_2



Answer: D

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10. Which of the following molecule contains one pair of non-bonding electrons?



Answer: B



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11. A resonance hybrid is always more stable than any of its canonical structures.

This stability is due to delocalization of electrons.

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

- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A

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Ordinary thinking (VSEPR Theory)

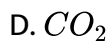
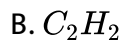
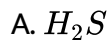
1. The $H - O - H$ bond angle in water is

- A. $120^{\circ} 28'$
- B. 60°
- C. 90°
- D. 105°

Answer: D

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



Answer: A

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3. H_2O is depolar, wheras BeF_2 is not. it because

A. H_2O is linear and BeF_2 is angular

B. H_2O is angular and BeF_2 is linear

C. The electronegativity of F is greater than that of O

D. H_2O involves hydrogen bonding whereas BeF_2 is a discrete molecule

Answer: B

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4. Which one has a pyramidal structure

A. CH_4

B. NH_3

C. H_2O

D. CO_2

Answer: B



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5. BCl_3 molecule is planar while NCl_3 is pyramidal because

- A. BCl_3 has no lone pair of electrons but NCl_3 has a lone pair of electrons
- B. B-Cl bond is more polar than N-Cl bond
- C. Nitrogen atom is smaller than boron atom
- D. N-Cl bond is more covalent than B-Cl bond

Answer: A



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6. In BrF_3 molecule, the lone pair occupies equatorial position to minimize

- A. Lone pair-lone pair repulsion and lone pair-bond pair repulsion
- B. Lone pair-lone pair repulsion only

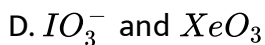
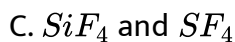
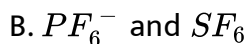
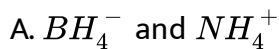
C. Lone pair -bond pair repulsion only

D. Bond pair-bond pair repulsion only

Answer: B

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



Answer: C

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8. Which of the following is not a correct statement

- A. Every AB_5 molecules does in fact have square pyramid structure
- B. Multiple bonds are always shorter than corresponding single bond
- C. The electron-deficient molecules can act as lewis acids
- D. The canonical structure have no real existence

Answer: A



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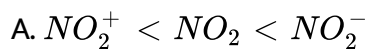
9. In which of the following pairs, the two species are isostructural :

- A. SF_4 and XeF_4
- B. SO_3^{2-} and NO_3^-
- C. BF_3 and NF_3
- D. BrO_3^- and XeO_3

Answer: D

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



Answer: D

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11. Predict the correct order among the following:

- A. Lone pair-lone pair gt lone pair -bond pair gtbond pair-bond pair
- B. Lone pair-lone pair gt bond pair-bond pairgtlone pair bond pair
- C. Bond pair -bond pair gt lone pair-bond pair gt lone pair-lone pair
- D. Lone pair-bond pair gt bond pair gt lone pair-lone pair

Answer: A

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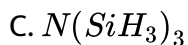
12. The isoelectronic pair is

- A. Cl_2O, ICl_2^-
- B. ICl_2^-, ClO_2
- C. IF_2^+, I_3^-
- D. ClO_2^-, ClF_2^+

Answer: D

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13. Planar structure is shown by



D. All of these

Answer: D



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14. XeF_2 molecule is

A. Linear

B. Triangular planar

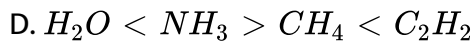
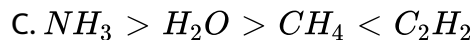
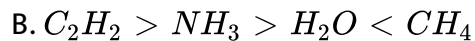
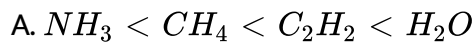
C. Pyramidal

D. Square planar

Answer: A

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15. The decreasing order of bond angle is



Answer: B

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16. Which of the following gives correct arrangement of compounds involved based on their bond strength?

A. HF gtHCl gt HBr gtHI

B. HIgtHBr gtHCl gtHF

C. HFgtHBr gtHCl gtHI

D. HCl gtHF gtHBr gtHI

Answer: A



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17. The shape of SO_4^{2-} ion is

A. Square planar

B. tetrahedral

C. trigonal bipyramidal

D. Hexagonal

Answer: B

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18. Which of the following has maximum bond angle?

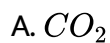


D. All have maximum bond angle

Answer: A

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



B. CS_2

C. $HgCl_2$

D. H_2O involves hydrogen bonding whereas BeF_2 is a discrete molecule

Answer: D

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20. In water molecule, the bond angle of 104.5° around oxygen is accounted due to

A. Repulsion between lone pair and bond pair

B. sp^3 hybridization of O

C. Bonding of H_2O

D. Higher electronegativity of O

Answer: A

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21. Among the following molecules : SO_2 , SF_4 , ClF_3 , BrF_5 , and XeF_4 , which of the following shapes does not describe any of the molecules mentioned ?

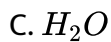
- A. Bent
- B. trigonal bipyramidal
- C. See-saw
- D. T-Shape

Answer: B

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22. Which of the following has the least bond angle ?

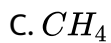
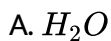
- A. NH_3



Answer: C

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23. Which of the following molecules has one lone pair of electrons on the central atom



Answer: B

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24. Discuss the shape of H_3O^+ using VSEPR model .

- A. Linear
- B. Angular
- C. Trigonal planar
- D. Trigonal pyramidal

Answer: D



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25. In NH_3 , bond angle is less than tetrahedral bond angle due to _____.

- A. Bond pair repulsion
- B. Lone pair repulsion
- C. Bond pair -lone pair repulsion

D. None of these

Answer: C

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26. In XeF_6 , oxidation state and of hybridisation of Xe and shape of the molecule are, respectively

A. +6, sp^3d^3 , distorted octahedral

B. +4, sp^3d^2 , square planar

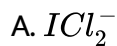
C. +6, sp^3 pyramidal

D. +6, sp^3d^2 , square pyramidal

Answer: A

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

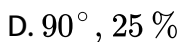
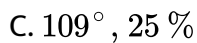
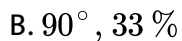
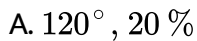


Answer: D



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28. The bond angle and % of d-character in SF_6 are



Answer: B

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29. Using the *VSEPR* theory, identify the type of hybridisation and draw the structure of OF_2 . What are the oxidation states of O and F ?

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

Answer: C

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30. The structure of $[Cu(H_2O)_4]^{++}$ ion is

- A. Square planar
- B. tetrahedral
- C. Distorted rectangle
- D. Octahedral

Answer: A

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31. Which one of the following compounds has bond angle close to 90° ?

- A. H_2O
- B. H_2S and $BeCl_2$
- C. NH_3
- D. CH_4

Answer: B

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32. Bond angle between two hybrid orbitals is 105° Percentage of s-orbital character of hybrid orbital is between

- A. Between 20-21%
- B. Between 19-20%
- C. Between 21-22%
- D. Between 22-23%

Answer: D



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33. In which of the following molecules, all atoms are coplanar?

- A. CH_4
- B. BF_3
- C. PF_5 and BrF_5

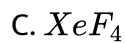


Answer: B



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34. One of the following is having square planar structure



Answer: C



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35. According to VSEPR theory, the most probable shape of the molecule having 4 electrons pairs in the outer shell of the central atom is

- A. Linear
- B. Tetrahedral
- C. Hexahedral
- D. Octahedral

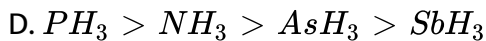
Answer: B



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

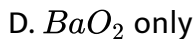
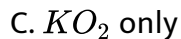
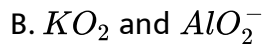
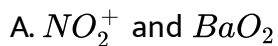
- A. $NH_3 > PH_3 > AsH_3 > SbH_3$
- B. $NH_3 > AsH_3 > PH_3 > NH_3$
- C. $SbH_3 > AsH_3 > PH_3 > NH_3$



Answer: A

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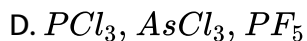
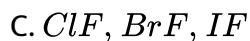
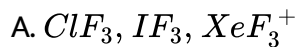
37. Among KO_2 , AlO_2^\ominus , BaO_2 and NO_2^+ , unpaired electrons is present in .



Answer: C

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38. Which of the following set do not have sp^3d hybridization



Answer: C



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39. The actual geometry of NO_2^- is

A. Planar

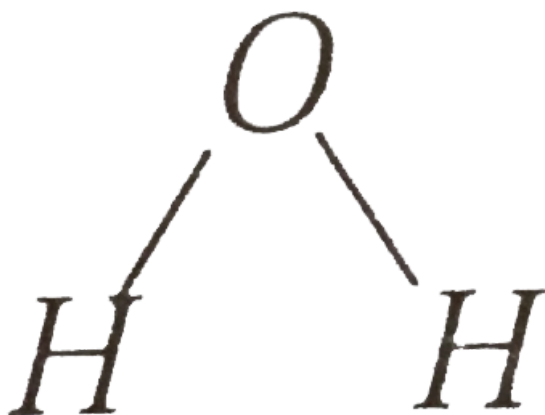
B. Linear

C. V shape

D. Tetrahedral

Answer: C

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40.

The bond angle in H_2O is 104.5° . This fact can be best explained with the help of

- A. Valence shell electron pair repulsion (VSEPR) theory
- B. Molecular orbital theory
- C. Presence of hydrogen bond

D. Electronegativity difference between hydrogen and oxygen atom

Answer: A

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41. The maximum number of 90° angles between bond pair-bond pair of electrons is observed in

A. dsp^2 hybridization

B. sp^3d hybridization

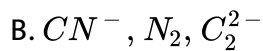
C. dsp^3 hybridization

D. sp^3d^2 hybridization

Answer: D

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42. Of the following sets which one does not contain isoelectronic species ?

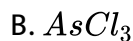


Answer: C



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43. The molecule having smallest bond angle is



Answer: C



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44. On comparison with H-C-H bond angle of methane, the C-N-C bond angle of trimethylamine is

- A. Higher
- B. No change
- C. Not comparable
- D. Lower

Answer: A



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45. $Cl - P - Cl$ bond angles in PCl_5 molecule are

A. 120° and 90°

B. 60° and 90°

C. 60° and 120°

D. 120° and 30°

Answer: A



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46. in compound X all the bond angles around central atom are $109^\circ 28'$
one of the following will be X ? .

A. Chloromethane

B. Iodoform

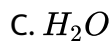
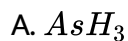
C. Carbon tetrachloride

D. Chloroform

Answer: C

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47. The largest bond angle in



Answer: B

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48. The shape of $XeOF_2$ on the basis of VSEPR theory is

A. See saw

B. V-shaped

C. Trigonal planar

D. T-Shape

Answer: D



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49. According to VSEPR theory, the shape of the water molecule is

A. ClF_3

B. NH_3

C. BF_3

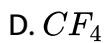
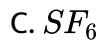
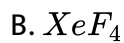
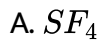
D. H_2O

Answer: A



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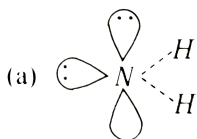
50. Two types FXF angles are present in which of the following molecules ($X = S, Xe, C$)?



Answer: A

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51. For $\overset{\ominus}{N}H_2$ the best three-dimensional view is .



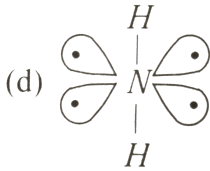
A.



B.



C.



D.

Answer: A



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52. The shape of ClO_3^- according to valence shell electron pair repulsion theory will be

A. Planar triangle

B. Pyramidal

C. Tetrahedral

D. Square planar

Answer: B

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53. A lone pair of electrons in an atom implies

A. A pair of valence electrons not involved in bonding

B. A pair of electrons involved in bonding

C. A pair of electrons

D. A pair of valence electrons

Answer: A

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54. A covalent molecule AB_3 has pyramidal structure. The number of lone pair and bond pair electrons in the molecule are respectively

- A. 0 and 4
- B. 3 and 1
- C. 1 and 3
- D. 2 and 2

Answer: C



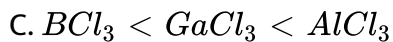
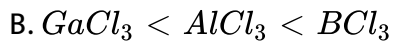
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55. Amongst the halides

1. BCl_3 , 2. $AlCl_3$
3. $GaCl_3$, 4. $InCl_3$

The order of decreasing Lewis acid character is



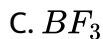
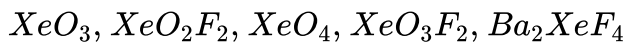


Answer: C



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56. Which of the following number of lone pair at central atom zero.

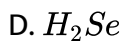
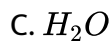


Answer: C



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57. Which one of the following molecules has the smallest bond angle ?

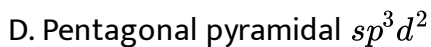


Answer: D



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58. Shape and hybridization of IF_5 , respectively, are



Answer: C

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59. The bond angle and dipole moment of water respectively are :

A. 109.5° , $1.84D$

B. 107.5° , $1.56D$

C. 104.5° , $1.84D$

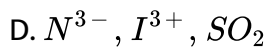
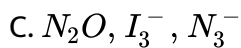
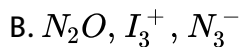
D. 102.5° , $1.56D$

Answer: C

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60. Among N_2O , SO_2 , I_3^+ and I_3^- , the linear species areand.....

A. NO_2^- , I_3^+ , H_2O



Answer: C

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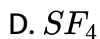
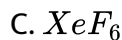
61. Correct order of Bond angle is



Answer: B

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62. Which of the following has a regular geometry



Answer: A



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63. Incorrect matching amongst the following is

(i) Linear - H_2O , SO_2 (ii) V-Shaped - CH_2 , $SnCl_2$

(iii) See Saw - SF_4 , $TeCl_4$ (iv) T-Shaped - ICl_3 , ClF_3

A. Only (i)

B. Both (i) and (ii)

C. only (iii)

D. Both (iii) and (iv)

Answer: A

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64. Which of the following species are planar ?

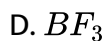
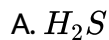


D. None of these

Answer: A

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65. In which of the following molecules, the central atom has one lone pair and three bond pairs of electrons,



Answer: C



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66. The shape of $(CH_3)^+$ is

A. tetrahedral

B. Square planar

C. Trigonal planar

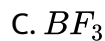
D. Linear

Answer: C



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67. Maximum bond angle is present in case of



D. Same for all

Answer: D



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68. Bond angle in PH_3 is



B. 105°

C. 109°

D. 120°

Answer: A



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69. Assertion : All F - S - F angle in SF_4 are greater than 90° but less than 180° .

Reason :The lone pair -bond pair repulsion is weaker than bond pair - bond pair repulsion

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

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

C. if assertion is true but reason is false

D. if the assertion and reason both are false

Answer: C

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70. Assertion :The S-S-S bond in S_8 molecule is 105° .

Reason : S_8 has V-shape.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: C

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71. Assertion : H-S-H bond angle in H_2S is closer to 90° but H-O-H bond angle in H_2O is 104.5°

Reason: lp-lp repulsion is stronger in H_2S than in H_2O

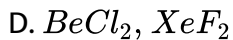
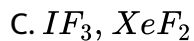
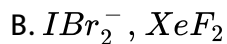
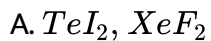
- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: B



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72. Which of the following pairs of compound is isoelectronic and isostructure ?



Answer: B



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73. In the structure of ClF_3 , the number of lone pairs of electrons on central atom 'Cl' is

A. One

B. two

C. Four

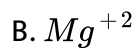
D. Three

Answer: B

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Ordinary thinking (Molecular orbital theory)

1. The size of Na^{\oplus} ion is same as that of

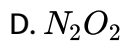
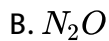


Answer: B

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2. Which of the following oxides of nitrogen is isoelectronic with CO_2

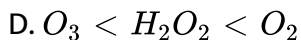
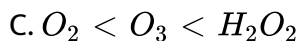
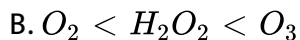
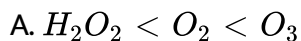




Answer: B

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



Answer: C

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4. The bond order in N_2 molecule is _____.

A. 1

B. 2

C. 3

D. 4

Answer: C



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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^- , the N-N bond weakens

B. In O_2^- , the O-O bond order increases

C. In O_2^- , bond length increases

D. N_2^- becomes diamagnetic

Answer: D

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6. In H_2O_2 molecule, the angle between the two O-H planes is

A. 90°

B. 101°

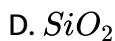
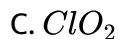
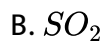
C. 103°

D. 105°

Answer: A

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7. Which one of the following oxides is expected to exhibit paramagnetic behaviour?



Answer: C



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

A. 4

B. 1

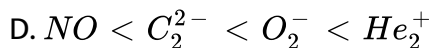
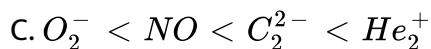
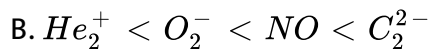
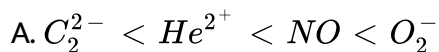
C. 2

D. 3

Answer: C

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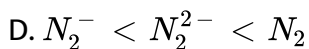
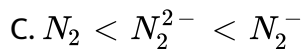
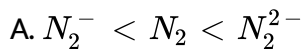
9. Four diatomic species are listed below in different sequences. Which of these represents the correct order of their increasing bond order?



Answer: B

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

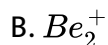


Answer: B



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



D. B_2

Answer: C

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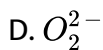
12. The pairs of species of oxygen and their magnetic behaviour are noted below. Which of the following presents the correct description ?

- A. O_2^+ , O_2 -Both paramagnetic
- B. O , O_2^{2-} -Both paramagnetic
- C. O_2^- , O_2^{2-} , Both diamagnetic
- D. O^+ , O_2^{2-} -Both paramagnetic

Answer: A

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



Answer: B



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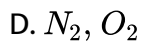
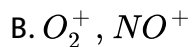
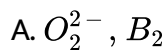
14. During change of O_2 to O_2^{2-} ion, the electrons add on which of the following orbitals ?



Answer: A

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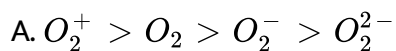
15. The pair of species with the same bond order is :

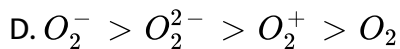
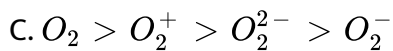
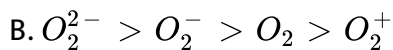


Answer: A

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16. Decreasing order of stability of O_2 , O_2^- , O_2^+ and O_2^{2-} is





Answer: A



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17. Bond order is a concept in the molecular orbital theory. It depends on the number of electrons in the bonding and antibonding orbitals. Which of the following statements is true about ? The bond order

A. Can have a negative quantity

B. Has always an integral value

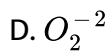
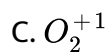
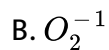
C. can assume any positive or integral or fractional value including zero

D. Is a non zero quantity

Answer: C

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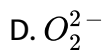
18. Bond length is maximum in



Answer: C

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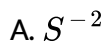
19. Which of the following species have maximum number of unpaired electrons ?



Answer: A

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20. Which of the following is not paramagnetic ?



Answer: A

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

A. F-F

B. C-C

C. N-N

D. O-O

Answer: C



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22. Molecular orbital theory was developed mainly by

A. pauling

B. pauling and slater

C. mulliken

D. Thomson

Answer: C



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23. The paramagnetic nature of oxygen molecules is best explained on the basis of

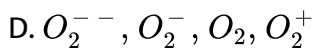
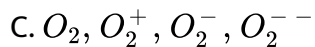
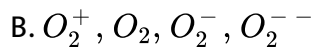
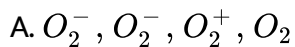
- A. Valence bond theory
- B. Resonance
- C. Molecular orbital theory
- D. Hybridization

Answer: C



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24. The increasing order of bond order of O_2 , O_2^+ , O_2^- and O_2^{2-} is :



Answer: D



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25. Which of the following complexes is paramagnetic

A. Chlorine

B. Nitrogen

C. Oxygen

D. Hydrogen

Answer: C



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26. Which has the highest bond energy?



Answer: B



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27. Which of the following is correct for N_2 triple bond



B. 1p,2s

C. 2p,1s

D. 3p

Answer: C



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28. The bond order in O_2^+ is the same as in :

A. N_2^+

B. CN^-

C. CO

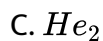
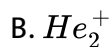
D. NO^+

Answer: A



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29. Which of the following does not exist on the basis of molecule orbital theory ?



Answer: C



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30. Bond energies in NO , NO^+ and NO^- are such as



Answer: C



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31. The bond order in N_2^+ ion is _____.

A. 1

B. 2

C. 2.5

D. 3

Answer: C



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

A. $(\sigma 2p_x)^1$ and $(\sigma^* 2p_x)^1$

B. $(\sigma 2p_x)^1$ and $(\pi 2p_y)^1$

C. $(\pi^* 2p_y)^1$ and $(\pi^* 2p_z)^1$

D. $(\pi^* 2p_y)^1$ and $(\pi 2p_y)^1$

Answer: C



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33. The paramagnetism of O_2^+ is due to the presence of an odd electron in the MO

A. $\sigma^* 2s$

B. $\pi 2p_y$

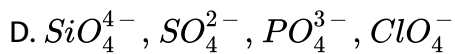
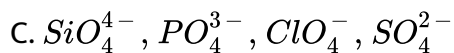
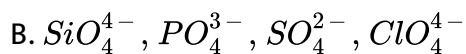
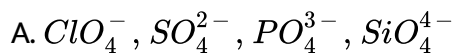
C. $\pi 2p_z$

D. $\pi^* 2p_y$

Answer: D

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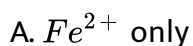
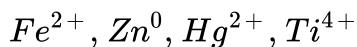
34. Arrange the following ions in the order of decreasing $X - O$ bond length where X is the central atom:

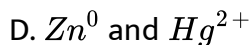
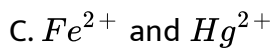
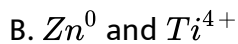


Answer: B

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35. Which of the following species is/are paramagnetic

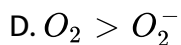
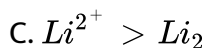
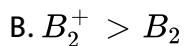
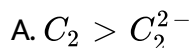




Answer: A

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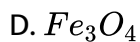
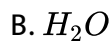
36. Which one of the following is not correct with respect to bond length of the species?



Answer: D

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37. The following species is repelled by a magnetic field



Answer: B



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38. Which of the following has the shortest bond length



Answer: A



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39. Which one of the following is the correct statement

- A. O_2 molecule has bond order 2 and is diamagnetic
- B. N_2 molecule has bond order 3 and is paramagnetic
- C. H_2 molecule has bond order zero and is diamagnetic
- D. C_2 molecules has bond order 2 and is diamagnetic

Answer: D



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40. Which one of the following is paramagnetic

- A. H_2O

B. NO_2

C. SO_2

D. CO_2

Answer: B

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41. If N_x is the number of bonding orbitals of an atom and N_y is the number of antibonding orbitals, then the molecule/atom will be stable if

A. $N_x > N_y$

B. $N_x = N_y$

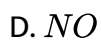
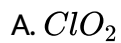
C. $N_x < N_y$

D. $N_x \leq N_y$

Answer: A

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42. Which one does not exhibit paramagnetism



Answer: B



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43. The bond order of O_2 and O_2^+ are _____ respectively.

A. 2

B. 1.5

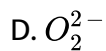
C. 3

D. 3.5

Answer: A

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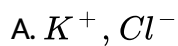
44. Which of the following is paramagnetic



Answer: C

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45. Isoelectronic species are



B. Na^+ , Cl^-

C. Na, Ar

D. Na^+ , Ar

Answer: A

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46. Which of the following is isoelectronic with carbon?

A. Na^+ and Ne

B. K^+ and O

C. Ne and O

D. Na^+ and K^+

Answer: A

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47. Bond order increases in which of the given transitions ?

- A. Energy and bond length increases
- B. Energy increases, bond length decreases
- C. Energy decreases, bond length increases
- D. Both decreases

Answer: B



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48. Bond order of N-O bonds in nitrate ion is

- A. 0.33
- B. 1
- C. 1.33
- D. 1.5

Answer: C

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49. Cl-O bond order in perchlorate ion is

A. 1.33

B. 1.5

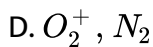
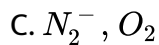
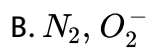
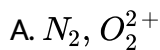
C. 1.75

D. 1.9

Answer: C

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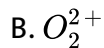
50. In which of the following pairs, the two molecules have identical bond orders :



Answer: A

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51. The bond order is of three for



Answer: A

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52. Identify the paramagnetic substance



Answer: A



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53. The bond order in O_2^+ is

A. 2

B. 2.5

C. 1.5

D. 3

Answer: B



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54. Paramagnetism is exhibited by molecules which

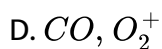
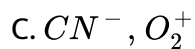
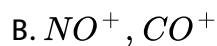
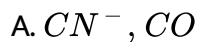
- A. Not attracted into a magnetic field
- B. Containing only paired electrons
- C. Carrying a positive charge
- D. Containing unpaired electrons

Answer: D



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55. Which of the following pairs of molecules have bond order three and are isoelectronic?



Answer: A



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56. Which of the following is paramagnetic ?



Answer: A



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57. How many bonding electron pairs are there in white phosphorus ?

A. 6

B. 12

C. 4

D. 8

Answer: A



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58. The total number of electrons that take part in forming the bond in

N_2 is .

A. 2

B. 4

C. 6

D. 10

Answer: C

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59. When two atoms combine to form a molecule .

A. One molecular orbital

B. Two molecular orbital

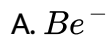
C. Three molecular orbital

D. Four molecular orbital

Answer: B

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60. Identify the least stable ion amongst the following:

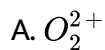


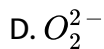
Answer: A



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

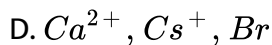
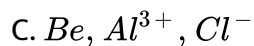
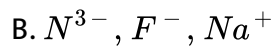
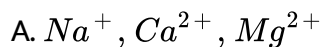




Answer: A

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62. Which one of the following groupings represents a collection of isoelectronic species ?



Answer: B

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63. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements 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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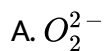
64. Which one of the following species is diamagnetic in nature ?

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

Answer: B

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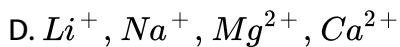
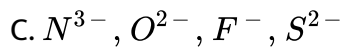
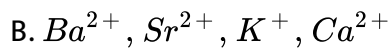
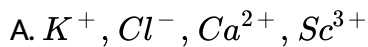
65. Which of the following molecules/ions does not contain unpaired electrons?



Answer: A

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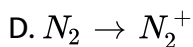
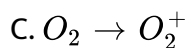
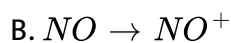
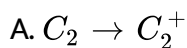
66. Which of the following sets of ions represents a collection of isoelectronic species ?



Answer: A

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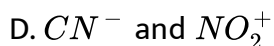
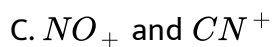
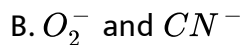
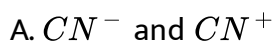
67. In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed?



Answer: B

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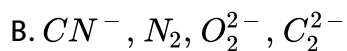
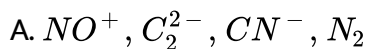
68. Which of the following pairs of species have the same bond order ?

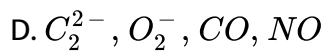
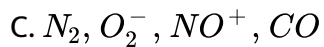


Answer: D

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69. Which one of the following constitutes a group of the isoelectronic species





Answer: A

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

A. 4

B. 3

C. 2

D. 5

Answer: A

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71. The bond order in He_2^+ ions is :

A. 1

B. 2

C. $\frac{1}{2}$

D. $\frac{1}{4}$

Answer: C



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

A. 3

B. 2

C. 1

D. $\frac{1}{2}$

Answer: C

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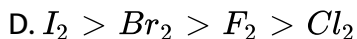
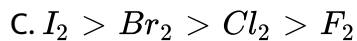
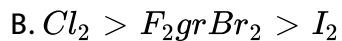
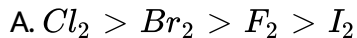
73. Which is false statement about LCAO

- A. Addition of atomic orbitals result in molecular orbitals
- B. Atomic orbitals of nearly same energy combine to form molecular orbitals
- C. Bonding molecular orbitals occupy higher energy than atomic orbitals
- D. Each molecular orbital accommodates maximum no. of two electrons

Answer: C

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74. The correct order of bond energy is:



Answer: A



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75. Peroxide ion.....

(i) Has five completely filled antibonding molecular orbitals

(ii) Is diamagnetic

(iii) Has bond order one

(iv) Is isoelectric with neon

Which one of these is correct

A. (iv) and (iii)

B. (i),(ii) and (iv)

C. (i),(ii) and (iii)

D. None of these

Answer: D

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

A. 7,6,8

B. 1,0,2

C. 6,6,6

D. 8,6,8

Answer: A

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77. N_2 accept electron and convert into N_2^- , where this electron goes

- A. Antibonding π molecules orbitals
- B. Bonding π molecular orbital
- C. σ bonding molecular orbitals
- D. σ -anti-bonding molecular orbital

Answer: A



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78. Which is the correct statement about σ and π molecular orbitals?

Statements are

- (i) π bonding orbitals are ungerade
- π antibonding orbitals are ungerade
- (iii) σ antibonding orbitals are gerade

A. (i) only

B. (ii) and (iii)

C. (iii) only

D. (ii) only

Answer: A

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79. In forming $(i)N_2 \rightarrow N_2^{\oplus}$ and $O_2 \rightarrow O_2^{\oplus}$ the electrons respectively removed from .

A. $(\pi^* 2p_y \text{ or } \pi^* 2p_x)$ and $(\pi^* 2p_y \text{ or } \pi^* 2p_x)$

B. $(\pi 2p_y \text{ or } \pi 2p_y)$ and $(\pi 2p_y \text{ or } 2p_x)$

C. $(\sigma 2p_z)$ and $(\pi^* 2p_y)$ or $\pi^* 2p_x$

D. $(\pi^* 2p_y \text{ or } \pi^* 2p_x)$ and $(\pi 2p_y \text{ or } \pi 2p_x)$

Answer: C

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80. Which of the following molecular orbitals has two nodal planes

A. $\sigma 2s$

B. $\pi 2p_y$

C. $\pi^* 2p_y$

D. $\sigma^* 2p_x$

Answer: C

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81. The number of nodal planes of d orbital has

A. zero

B. one

C. two

D. three

Answer: C

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82. Which of the following has the highest bond energy?

A. N_2

B. O_2

C. He_2

D. H_2

Answer: A

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83. The number of nodal planes present in a σ^* antibonding orbital is

A. 0

B. 3

C. 1

D. 2

Answer: C

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84. The correct statement with regard to H_2^+ and H_2^- is

A. Both H_2^+ and H_2^- do not exist

B. H_2^- is more stable than H_2^+

C. H_2^+ is more stable than H_2^-

D. Both H_2^+ and H_2^- are equally stable

Answer: B

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85. The bond order in O_2^- ion is

A. 2

B. 1

C. 2.5

D. 1.5

Answer: D



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86. The paramagnetic behaviour of B_2 is due to the presence of

A. 2 unpaired electrons in $\pi_n MO$

B. 2 unpaired electrons in $\pi^{**} MO$

C. 2 unpaired electrons in $\sigma^* MO$

D. 2 unpaired electrons in $\sigma_b MO$

Answer: A

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87. In the process, $O_2^+ \rightarrow O_2^{+2} + e$ the electron lost is from

- A. Bonding π -orbital
- B. Antibonding π -orbital
- C. $2p_z$ orbital
- D. $2p_x$ orbital

Answer: B

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88. Bond order and magnetic moment of CO^+ is

A. 2.5 and paramagnetic moment

B. 3.5 and diamagnetic moment

C. 3.5 and paramagnetic moment

D. 2.5 and diamagnetic moment

Answer: C

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

A. σ -orbital

B. π -orbital

C. σ^* orbitals

D. π^* orbital

Answer: D

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90. Which of the following species is expected to be paramagnetic ?

A. Copper crystals

B. Cu^+

C. Cu^{++}

D. H_2

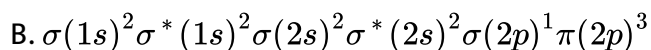
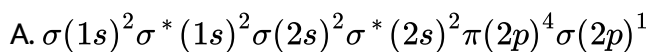
Answer: C

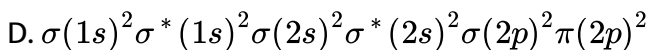
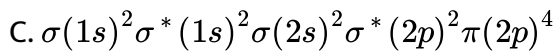


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91. From elementary molecular orbital theory we can deduce the electronic configuration of the singly positive nitrogen molecular ion N_2^+

as

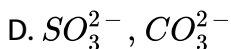
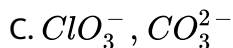
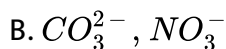
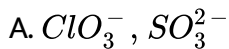




Answer: A

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



Answer: B

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93. With increasing bond order, strength of a bond

- A. Remain unaltered
- B. Decreases
- C. Increases
- D. None of these

Answer: C



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94. Which of the following is diamagnetic

- A. Oxygen molecule
- B. Boron molecule
- C. N_2^+
- D. None

Answer: D



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95. Which of the following is correctly based on molecular orbital theory for peroxide ion?

- A. Its bond order is two and it is diamagnetic
- B. Its bond order is one and it is paramagnetic
- C. Its bond order is two and it is paramagnetic
- D. Its bond order is one and it is diamagnetic

Answer: D



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96. The bond order of a molecule is given by _____.

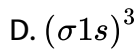
- A. The difference between the number of electrons in bonding and antibonding orbitals
- B. Total number of electrons in bonding and antibonding orbitals
- C. Twice the difference between the number of electrons in bonding and antibonding electrons
- D. Half the difference between the number of electrons in bonding and antibonding electrons

Answer: D

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97. The molecular electronic configuration of H_2^- ion is

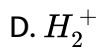
- A. $(\sigma 1s)^2$
- B. $(\sigma 1s)^2(\sigma^* 1s)^2$
- C. $(\sigma 1s)^2(\sigma^* 1s)^1$



Answer: C

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98. Which one is paramagnetic and has the bond order $1/2$



Answer: D

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99. Of the following statements, which one is correct

- A. Oxygen and nitric oxide molecules are both paramagnetic because both contain unpaired electrons
- B. Oxygen and nitric oxide molecules are both diamagnetic because both contain no unpaired electrons
- C. Oxygen is paramagnetic because it contains unpaired electrons, while nitric oxide is diamagnetic because it contains no unpaired electrons
- D. Oxygen is diamagnetic because it contains no unpaired electrons, while nitric oxide is paramagnetic because it contains an unpaired electron

Answer: A



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100. The difference in energy between the molecule orbital formed and the combining atomic orbitals is called

- A. Bond energy
- B. Activation energy
- C. Stabilization energy
- D. Destabilization energy

Answer: C

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101. Assertion: Nitrogen molecule is diamagnetic.

Reason: N_2 molecule have unpaired electrons.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false

D. if the assertion and reason both are false

Answer: C

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102. Assertion: Bond energy has order like $C - C < C = C < C \equiv C$.

Reason: Bond energy increases with increase in bond order.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A

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103. Assertion: The bond order of helium molecule is always zero.

Reason: The number of electrons in bonding molecular orbital and antibonding molecular orbital is equal.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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104. Assertion(A) - Fluorine molecule has bond order one.

Reason(R)-The number of electrons in antibonding molecular orbital is

two less than that of bonding molecular orbitals.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A

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105. Assertion B_2 molecule is diamagnetic

Reasoning The highest occupied molecular orbital is of sigma type .

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

- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: D

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106. Which of the following pairs of species have the same bond order

- A. O_2, NO^+
- B. CN^-, CO
- C. N_2, O_2^-
- D. CO, NO

Answer: B

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107. Consider the following species

CN^- , CN^+ , NO and CN .

Which one of these will have the highest bond order ?

A. NO

B. CN^-

C. CN^+

D. CN

Answer: B



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Ordinary thinking (Hydrogen bonding)

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

A. SiH_4

B. LiH

C. HI

D. NH_3

Answer: D

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

A. Hydrogen bonding interaction

B. Dipole- dipole interactions

C. Dipole-induced dipole interactions

D. Induced dipole-induced dipole interactions

Answer: A

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3. What is the dominant intermolecular forces or bond that must be overcome in converting liquid CH_3OH to gas ?

- A. Hydrogen bonding
- B. Dipole-dipole interaction
- C. Covalent bonds
- D. London dispersion force

Answer: A



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4. The variation of the boiling points of the hydrogen halides is in the order $HF > HI > HBr > HCl$.

What explains the higher boiling point of hydrogen fluoride?

- A. The electronegativity of fluorine is much higher than for other elements in the group
- B. There is strong hydrogen bonding between HF molecules
- C. The bond energy of HF molecules is greater than in other hydrogen halides
- D. The effect of nuclear shielding is much reduced in fluorine which polarises the HF molecule

Answer: B

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5. Which of the following explanations accounts for o-nitro-phenol to be more volatile than p-nitrophenol?

- A. Resonance
- B. Hyperconjugation

C. Hydrogen bonding

D. Steric hindrance

Answer: C

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6. Hydrogen bonding is not present in

A. Glycerine

B. Water

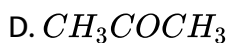
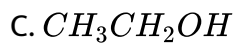
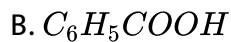
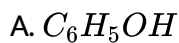
C. Hydrogen sulphide

D. Hydrogen fluoride

Answer: C

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7. H-bonding is maximum in



Answer: B



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8. 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 α -carbon

Answer: B

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9. Ethanol and Methanol are miscible in water due to

- A. Covalent character
- B. Hydrogen bonding character
- C. Oxygen bonding character
- D. None of these

Answer: B

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10. Compounds showing hydrogen bonding among HF , NH_3 , H_2S and PH_3 are

A. Only HF , NH_3 and PH_3

B. Only HF and NH_3

C. only NH_3 , H_2S and PH_3

D. All the four

Answer: B

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11. Water has high heat of vaporisation due to ?

A. Covalent bonding

B. H-bonding

C. Ionic bonding

D. None of the above

Answer: B

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12. Intramolecular hydrogen bond is present in

- A. Water
- B. o-nitrophenol
- C. p-nitrophenol
- D. methylamine

Answer: B



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13. Strength of hydrogen bond is intermediate between

- A. Vander waal and covalent
- B. Ionic and covalent
- C. Ionic and metallic

D. Metallic and covalent

Answer: A

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14. The boiling point of a compound is raised by _____.

A. Intramolecular hydrogen bonding

B. Intermolecular hydrogen bonding

C. covalent bonding

D. Ionic covalent

Answer: B

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15. Contrary to other hydrogen halides, hydrogen fluoride is liquid because

- A. Size of F atom is small
- B. HF is a weak acid
- C. HF molecules are hydrogen bonded
- D. Fluorine is highly reactive

Answer: C



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16. HCl is a gas where/ as HF is a low boiling point liquid because :

- A. H-F bond is strong
- B. H-F bonding is weak
- C. Molecules aggregate because of hydrogen bonding
- D. HF is weak acid

Answer: C

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17. The reason for exceptionally high boiling point of water is

- A. Its high specific heat
- B. Its high dielectric constant
- C. Low ionization of water molecules
- D. Hydrogen bonding in the molecules of water

Answer: D

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18. which of the following hydrogen bond is strongest in vapour phase ?

- A. HF---HF

B. HF---HCl

C. HCl---HCl

D. HF---HI

Answer: A

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19. How many hydrogen-bonded water molecule(s) are associated in $CuSO_4 \cdot 5H_2O$?

A. 1

B. 2

C. 3

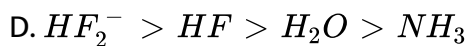
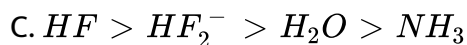
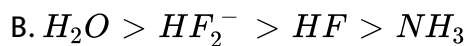
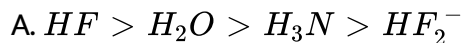
D. 4

Answer: A

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20. The hydrogen bonds are encountered in HF , H_2O , NH_3 and HF_2^- .

The relative order of energies of hydrogen bonds is



Answer: D

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21. Which of the following is sparingly soluble in water ?

A. 2,6 dihydrobenzoic acid

B. p-nitrophenol

C. o-nitrophenol

D. Ethanoic acid

Answer: C

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

A. Chlorofom

B. Ethyl alcohol

C. Acetic acid

D. Ethyl ether

Answer: D

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23. 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 ,

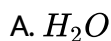
- A. Hydrogen bonding
- B. Ionic bonding
- C. Coordinating covalent bonding
- D. Resonance

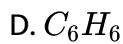
Answer: A



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24. Which of the following compounds in liquid state does not have hydrogen bonding

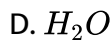




Answer: D

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25. Which of the following compound can form hydrogen bonds



Answer: D

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26. In which of the following compounds intramolecular hydrogen bond is present

- A. Ethyl alcohol
- B. Water
- C. Salicylaldehyde
- D. Hydrogen sulphide

Answer: C



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27. Hydrogen bonding is formed in compounds containing hydrogen and _____.

- A. Highly electronegative atoms
- B. Highly electropositive atoms
- C. Metal atoms with d-orbitals occupied

D. Metalloids

Answer: A

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28. which one has the highest bp

A. Acetone

B. Ethyle alcohol

C. Diethyl ether

D. Chloroform

Answer: B

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29. H_2O is a liquid while H_2S is a gas.

- A. Covalent bonding
- B. Molecular attraction
- C. H-bonding
- D. H-bonding and molecular attraction

Answer: C

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30. NH_3 has a much higher bp than PH_3 because

- A. NH_3 has a larger molecular weight
- B. NH_3 undergoes umbrella inversion
- C. NH_3 forms hydrogen bond
- D. NH_3 contains ionic bonds whereas PH_3 contains covalent bonds

Answer: C

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31. Hydrogen bond energy is equal to

- A. 3-7 cal
- B. 30-70 cal
- C. 3-10 cal
- D. 30-70 cal

Answer: C



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32. Which of the following has minimum PH.

- A. CsF
- B. HCl
- C. HF

D. LiF

Answer: B



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33. Which of the following compound has the highest boiling point

A. HCl

B. HBr

C. H_2SO_4

D. HNO_3

Answer: C



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34. 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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35. 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. Vander waal,s forces

B. Hydrogen bond formation

C. Covalent attraction

D. Dipole-dipole attraction

Answer: B

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36. B.P of $H_2O(100^\circ C)$ and $H_2S(\equiv 42^\circ C)$ is explained by

A. Vander waal's forces

B. covalent bond is weaker than ionic bond

C. Hydrogen bond

D. Ionic bond

Answer: C

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37. Assertion : Boiling point of p-nitrophenol is greater than that of o-nitrophenol.

Reason : There is intramolecular hydrogen bonding in p-nitrophenol and intermolecular hydrogen bonding in o-nitrophenol.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if assertion is false but reason in true.

Answer: c



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38. Assertion : Ice is less dense than liquid water.

Reason: There are vacant spaces between hydrogen bonded water molecules in ice.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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39. Assertion: *o* – and *p*-nitrophenol can be separated by steam distillation.

Reason: *o* – nitrophenols have intramolecular hydrogen bonding while *p*-nitrophenols exists as associated molecules.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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40. Assertion : The nearly tetrahedral arrangement of the orbitals about the oxygen atom allows each water molecules to form hydrogen bonds with as many as four neighbouring water molecules.

Reason: In ice each molecule forms four hydrogen bonds as each molecule is fixed in the space.

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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Ordinary thinking (Types of bonding and force in solid)

1. Which of the following does not apply to metallic bond ?

A. Overlapping valency orbitals

B. Mobile valency electrons

C. Delocalized electrons

D. Highly directed bonds

Answer: D

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2. Which of the following exhibits the weakest intermolecular forces?

A. He

B. HCl

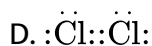
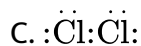
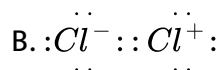
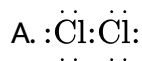
C. NH_3

D. H_2O

Answer: A

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3. Which of the following is the correct electronic formula of chlorine molecule



Answer: A



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4. In melting lattice, structure of solid

A. Remain unchanged

B. Change

C. becomes compact

D. None of the above

Answer: B

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5. Which of the following statement is true about $[Cu(NH_3)_4]SO_4$

A. It has coordinate and covalent bonds

B. It has only coordinate bonds

C. It has only electrovalent bonds

D. IT has electrovalent , covalent and coordinate bonds

Answer: D

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6. Which of the following has the highest mp

A. Pb

B. Diamond

C. Fe

D. Na

Answer: B

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7. Among the following the weakest one is

A. Metallic bond

B. Ionic bond

C. Van der waal's force

D. Covalent bond

Answer: C

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8. In the formation of a molecule by an atom ?

- A. Attractive forces operate
- B. Repulsive forces operates
- C. Both attractive and repulsive forces operate
- D. None of these

Answer: C



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9. Lattice energy of alkali metal chlorides follows the order

- A. $LiCl > NaCl > KCl > RbCl > CsCl$
- B. $CsCl > NaCl > KCl > RbCl > LiCl$
- C. $LiCl > CsCl > NaCl > KCl > RbCl$



Answer: A



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10. In the following metals which one has lowest probable inter-atomic forces ?

A. Copper

B. Silver

C. Zinc

D. Mercury

Answer: D



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11. The number of ionic, covalent and coordinate bonds in NH_4Cl are respectively

- A. 1,3 and 1
- B. 1,3 and 2
- C. 1,2 and 3
- D. 1,1 and 3

Answer: A



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12. In dry ice , there are :

- A. only covalent bond
- B. only ionic bond
- C. only vander waal's force of attraction
- D. covalent and vander waal's force of attraction

Answer: D



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

- A. Ionic bonds
- B. Hydrogen bonds
- C. Vander waal's forces
- D. Hydrophobic forces

Answer: C



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14. Pure covalent molecules are usually held in a crystal structure by

- A. Dipole-dipole attraction

B. Electrostatic attraction

C. Hydrogen bonds

D. Vander waal's attraction

Answer: D



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15. Which has the weakest bond

A. Diamond

B. Neon(solid)

C. KCl

D. Ice

Answer: B



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16. Glycerol has strong intermolecular bonding therefore it is

- A. Sweet
- B. Reactive
- C. Explosive
- D. Viscous

Answer: B::D

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17. Which of the following statements is true

- A. HF is less polar than HBr
- B. Absolutely pure water does not contain any ions
- C. Chemical bond formation take place when fores of attraction overcome the force of repulsion

D. in covalency transference of electron takes place

Answer: C

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18. Both ionic and covalent bond is present in the following

A. CH_4

B. KCl

C. SO_2

D. $NaOH$

Answer: D

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19. Which type of bond is present in Xe molecule ?

A. Covalent

B. Ion-dipole

C. Van der waal's force

D. Dipole-dipole

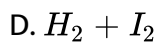
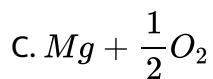
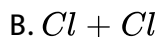
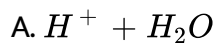
Answer: C



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Critical thinking(Objective question)

1. Which combination is best explained by the co-ordinate covalent bond



Answer: A

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2. N_2 and O_2 are converted into monocations, N_2^+ and O_2^+ respectively.

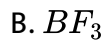
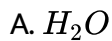
Which of the following is wrong?

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

Answer: D

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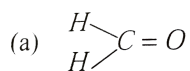
3. Which of the following species contains three bond pairs and one lone pair around the central atom



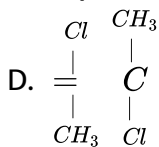
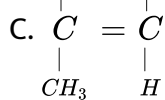
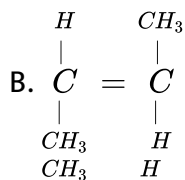
Answer: D

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



A.



Answer: A



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5. Which of the following arrangement of molecules is correct on the basis of their dipole moments



Answer: D



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6. Sulphur reacts with chlorine in 1:2 ration and forms X . Hydrolysis of X gives a sulphur compound Y. what is the structure and hybridisation of

anion of Y

A. Tetrahedral, sp^3

B. Linear, sp

C. Pyramidal, sp^3

D. Trigonal planar, sp^2

Answer: C



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7. Bond length of ethane (I), ethene (II), acetylene (III) and benzene (IV) follows the order

A. IgtIIgtIII gtIV

B. IgtIIgtIVgtIII

C. IgtIVgtIIgtIII

D. IIIgtIVgtIIgtI

Answer: B



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8. Match the list I and list II and write the correct matching

List I
Species

A. H_3O^+

B. $H_2C = NH$

C. ClO_2^-

D. NH_4^+

E. PCl_5

List II
Geometry

1. Planar

2. Angular

3. Tetrahedral

4. Trigonal bipyramidal

5. Pyramidal

A. A-2,B-1,C-3,D-5,E-4

B. A-1,B-5,C-2,D-3,E-4

C. A-5,B-1,C-2,D-3,E-4

D. A-1,B-5,C-2,D-3,E-2

Answer: C

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9. O_2^{2-} is the symbol of Ion

- A. Oxide
- B. Superoxidw
- C. Peroxide
- D. Monoxide

Answer: C

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10. 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. 0.43

C. 0.533

D. 0.7224

Answer: D



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11. Fluorine reacts with dilute NaOH and forms a gaseous product A. The bond angle in the molecule of A is

A. $104^{\circ} 40'$

B. 103°

C. 107°

D. $109^{\circ} 28'$

Answer: B

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12. Hybridisation state of chlorine in ClF_3 is

A. sp^3

B. sp^3d

C. sp^3d^2

D. sp^3d^3

Answer: B

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

A. NH_4Cl

B. $NaCl$

C. CaOC

D. NH_3

Answer: A

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14. Which one of the following contains ionic, covalent and co-ordinate and coordinate linkage is

A. NaOH

B. NaCl

C. NaCN

D. NaNC

Answer: D

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

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

Answer: B



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16. The magnetic moment of $K_3[Fe(CN)_6]$ is found to be 1.7 B.M. how many unpaired electron (s) is/are present per molecule

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

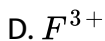
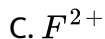
D. 4

Answer: A



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

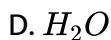
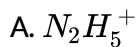


Answer: B



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18. Which of the following contains a coordinate and covalent bond

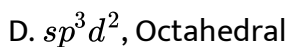
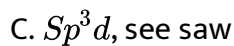
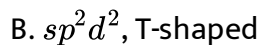
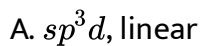


Answer: A



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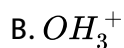
19. Structure of IF_4^+ and hybridization of iodine in this structure are



Answer: C

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



Answer: A

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21. The ionisation of hydrogen atom would give rise to

A. Hybrid ion

B. Hydronium ion

C. Proton

D. Hydroxyl ion

Answer: C

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22. Which can be described as a molecule with residual bonding capacity

A. $BeCl_2$

B. $NaCl$

C. CH_4

D. N_2

Answer: A

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JEE Section (Only one choice correct answer)

1. Which one in the following contains ionic as well as covalent bond



Answer: C



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2. The number of electrons involved in the bond formation of N_2 molecule are _____.

A. 2

B. 4

C. 6

D. 10

Answer: C



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3. Select the compound from the following which dissolves in water

A. CCl_4

B. CS_2

C. $CHCl_3$

D. C_2H_5OH

Answer: D



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4. 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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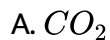
5. If molecule MX_3 has zero dipole moment, the sigma bonding orbitals used by M (atomic number < 21) are

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

Answer: C

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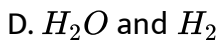
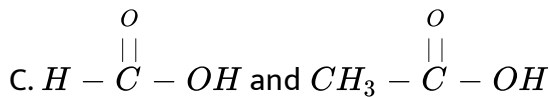
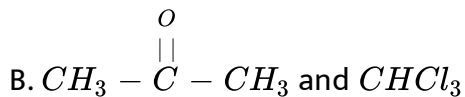
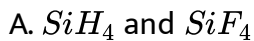
6. In which of the following is the angle between the two covalent bonds greatest



Answer: A

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7. Strongest intermolecular hydrogen bond is present in the following molecules pairs



Answer: C

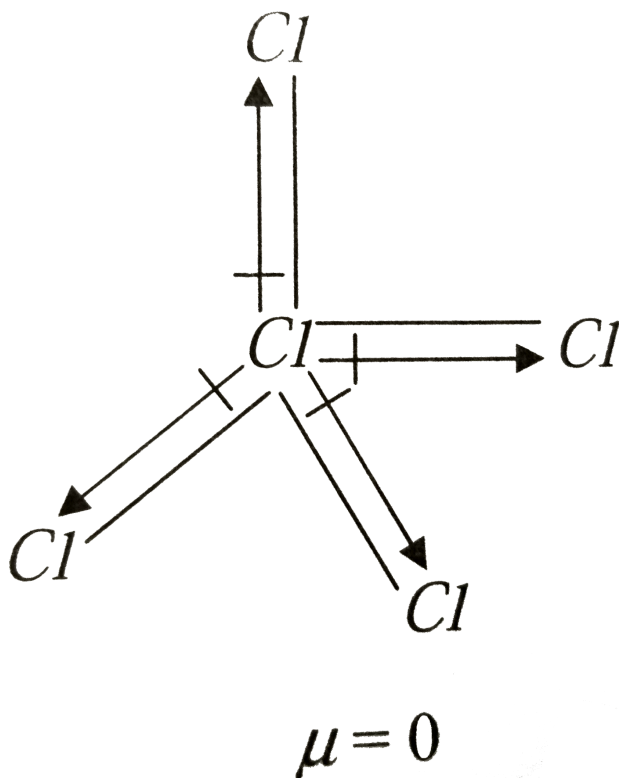
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8. The ion that is isoelectronic with CO is



Answer: A

9. Carbon tetrachloride has no net dipole moment because of



A. its planar structure

B. its regular tetrahedral structure

C. Similar sizes of carbon and chlorine atoms

D. Similar electron affinities of carbon and chlorine

Answer: D

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10. Which molecules is linear

A. NO_2

B. ClO_2

C. CO_2

D. H_2S

Answer: C

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

- A. Phenol
- B. Liquid NH_3
- C. water
- D. liquid HCl

Answer: D

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12. Bonds presents in $CuSO_4 \cdot 5H_2O$ is

- A. Electrovalent and covalent
- B. Electrovalent and coordinate covalent
- C. Electrovalent , covalent and coordinate covalent
- D. Covalent and coordinate covalent

Answer: C

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13. The compound 1, 2 – butadiene has :

- A. only Sp hybridized carbon atoms
- B. only sp^2 hybridized carbon atoms
- C. both sp and sp^2 hybridized carbon atoms
- D. sp , sp^2 and sp^3 hybridized carbon atoms

Answer: D



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14. One hybridization of one s and one p orbital we get

- A. Two mutually perpendicular orbitals
- B. Two orbitals at 180°
- C. Four orbitals directed tetrahedrally

D. Three orbitals in a plane

Answer: B

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15. According to molecular orbital theory, the paramagnetism of O_2 molecule is due to the presence of

- A. Unpaired electrons in the bonding σ molecular orbital
- B. Unpaired electrons in the antibonding σ molecular orbital
- C. unpaired electron in the bonding π molecular orbital
- D. Unpaired electrons in the antibonding π molecular orbital

Answer: D

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16. The molecule having one unpaired electron is

A. NO

B. CO

C. CN^-

D. O_2

Answer: A



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

A. Dissimilar shared between the two

B. By complete transfer from one atom to other

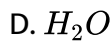
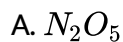
C. In a similar spin condition

D. Equally shared in between the two

Answer: D

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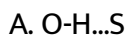
18. Which of the following contains a coordinate covalent bond?



Answer: A

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19. The H-bond is strongest in



B. S-H...O

C. F-H...F

D. S-H...O

Answer: C

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20. The hybridization of sulphur in SO_2 is

A. sp

B. sp^3

C. sp^2

D. dsp^2

Answer: C

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21. Zero dipole moment is present in

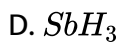


Answer: D



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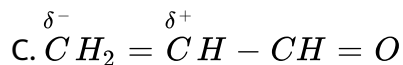
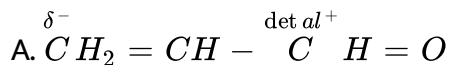
22. The species in which the central atom uses sp^2 hybrid orbital in its bonding is:



Answer: C

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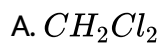
23. Polarization of electrons in acrolein may be written as:

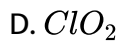
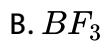


Answer: D

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24. The molecule which has zero dipole moment is

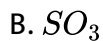




Answer: A

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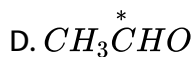
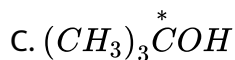
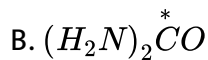
25. The molecule which has pyramidal shape is



Answer: A

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26. The compound in which C uses its sp^3 -hybrid orbitals for bond formation is

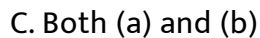


Answer: C



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27. Which one is paramagnetic from the following



Answer: C

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

A. sp^3

B. sp^2

C. sp

D. None of these

Answer: A

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

A. 2

B. 4

C. 3

D. 1

Answer: B



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30. The high following points and insolubility in organic solvents of sulphanic acid are due to itsstructure

A. Simple ionic

B. Bipolar ionic

C. Cubic

D. Hexagonal

Answer: B

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31. The two types of bonds present in B_2H_6 are covalent and ____.

- A. Three centre bond
- B. Hydrogen bond
- C. Two centre bond
- D. None of the above

Answer: A

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32. Which one is most ionic ?

- A. P_2O_5
- B. CrO_3
- C. MnO

D. Mn_2O_7

Answer: C



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33. In P_4O_{10} the number of oxygen atoms bonded to each phosphorus atom is.....

A. 2

B. 3

C. 4

D. 2.5

Answer: C



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34. The number of electrons that are paired in oxygen molecule is

A. 7

B. 8

C. 14

D. 16

Answer: C



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35. When N_2 goes to N_2^+ , the $N - N$ bond distance, and when O_2 goes to O_2^+ the $O - O$ bond distance.....

A. Decreases , increases

B. Increases, decreases

C. Increases, increases

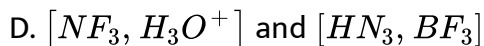
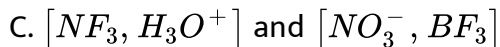
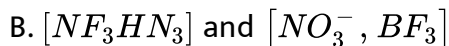
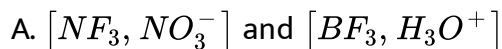
D. None of these

Answer: B



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36. Among the following species, identify the isostuctural pairs



Answer: C



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

A. one sigma, one pi

B. one sigma, two pi

C. Two sigma, one pi

D. two sigma, two pi

Answer: B



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38. Arrange the following compounds in order of increasing dipole moment:

(i) toluene (ii) m-dichloro benzene

(iii) o-dichloro benzene (iv) p-dichloro benzene

A. II<IV<III<I

B. IV<I<III<II

C. IV<I<III<II

D. IV<III<I<II

Answer: B

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39. Among KO_2 , AlO_2^\ominus , BaO_2 and NO_2^+ , unpaired electrons is present in .

A. NO_2^+ and BaO_2

B. KO_2 and AlO_2^-

C. KO_2 only

D. BaO_2 only

Answer: C

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40. Which contains both polar and non-polar bonds ? .

A. NH_4Cl

B. HCN

C. H_2O_2

D. CH_4

Answer: A



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

A. Fewer electrons than O_2

B. Two covalent bonds

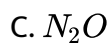
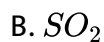
C. V-shaped

D. Dipole moment

Answer: D

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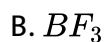
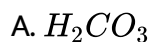
42. Which of the following compounds has sp^2 -hybridisation?

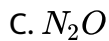


Answer: B

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43. Among the following the compounds , the one that is polar and has central atom with sp^2 hybridisation is

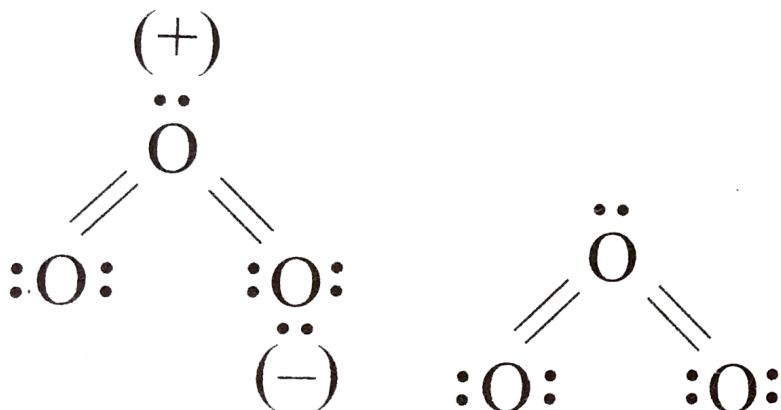




Answer: A

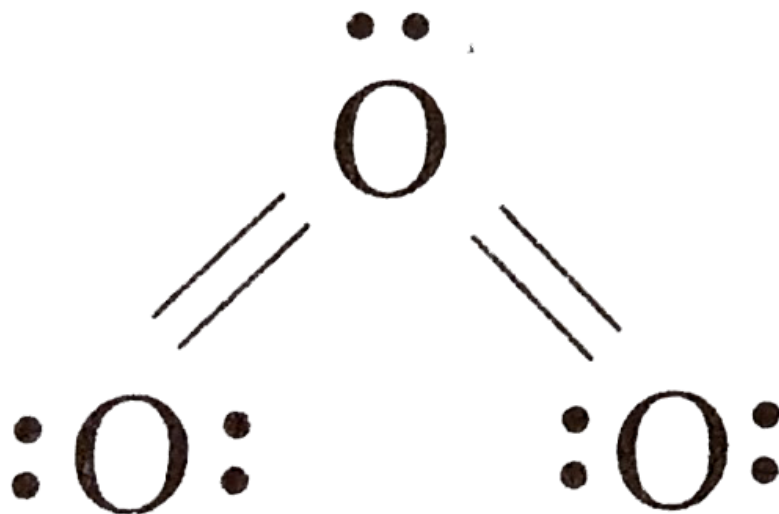
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44. Assertion: The electronic structure of O_3 is:



Reason: structure is not allowed because octet around O cannot be

expanded



- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: A



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45. Statement I $LiCl$ is predominantly a covalent compound.

Statement II Electronegativity difference between Li and Cl is too small

- A. If both assertion and reason are true and the reason is the correct explanation of the assertion
- B. if both assertion and reason are true but reason is not the correct explanation of the assertion
- C. if assertion is true but reason is false
- D. if the assertion and reason both are false

Answer: C



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46. The geometry and the type of hybrid orbitals present about the central atom in BF_3 is :

A. Linear, sp

B. Trigonal planar, sp^2

C. Tetrahedral, sp^3

D. Pyramidal, sp^3

Answer: B

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47. The shape of XeF_4 molecule is

A. Linear

B. Pyramidal

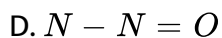
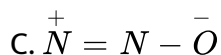
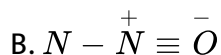
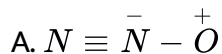
C. Tetrahedral

D. Square planar

Answer: D

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48. Which of the following resonating structure of N_2O is the most contributing ?

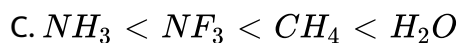
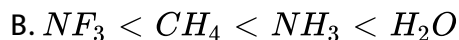
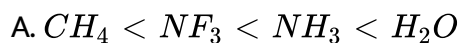


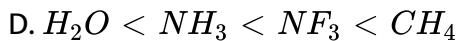
Answer: A



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49. The correct order of dipole moment is :

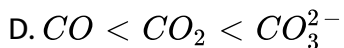
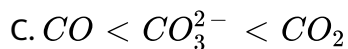
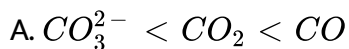




Answer: A

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



Answer: D

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51. 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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52. In the compound

$CH_2 = CH - CH_2 - CH_2 - C \equiv CH$ the $C_2 - C_3$ bond is of

A. $sp - sp^2$

B. $sp^3 - sp^3$

C. $sp - sp^3$

D. $sp^2 - sp^3$

Answer: D

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53. The molecular shapes of SF_4 , CF_4 and XeF_4 are :

- A. The same, with 2, 0 and 1 lone pair of electrons respectively
- B. The same, with 1,1 and 1 lone pairs of electrons respectively
- C. Different, with 0,1 and 2 lone pairs of electrons respectively
- D. Different with 1,0 and 2 lone pairs of electrons respectively.

Answer: D

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54. The hybridization of atomic orbitals of nitrogen is NO_2^+ , NO_3^- , and NH_4^+ respectively are

A. sp , 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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55. The order of dipole moment of the following molecules is

A. $CHCl_3 > CH_2Cl_2 > CH_3Cl > CCl_4$

B. $CH_2Cl_2 > CH_3Cl > CHCl_3 > CCl_4$

C. $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$

D. $CH_2Cl_2 > CHCl_3 > CH_3Cl > CCl_4$

Answer: D

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56. The common features among the species CN^- , CO and NO^+

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

Answer: A



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57. 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 , dsp^3 , sp^2
- C. dsp^2 , sp^2 , sp^3 , dsp^3

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

Answer: B

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58. 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^2

D. N: Pyramidal, sp^3 , B: tetrahedral, sp^3

Answer: A

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59. Identify the least stable ion amongst the following:

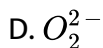


Answer: B



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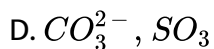
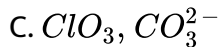
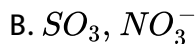
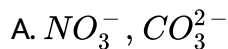
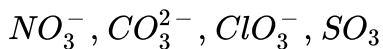
60. Which of the following molecular species has unpaired electron(s) ? .



Answer: C

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61. Which of the following are isoelectronic and isostructural ?



Answer: A

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62. According to *MOT* which of the following statement about magnetic character and bond order is correct regarding O_2^\oplus .

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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63. The acid having O - O bond is

A. $H_2S_2O_3$

B. $H_2S_2O_6$

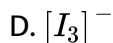
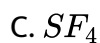
C. $H_2S_2O_8$

D. $H_2S_4O_6$

Answer: C

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

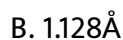


Answer: D



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65. If the bond length of CO bond in carbon monoxide is 1.128\AA , then what is the value of CO bond length in $Fe(CO)_5$?



C. 1.72\AA

D. 1.118\AA

Answer: A

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

A. NO^-

B. NO^+

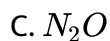
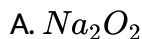
C. CN^-

D. N_2

Answer: A

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67. Among the following , the paramagnetic compound is

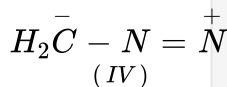
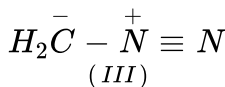
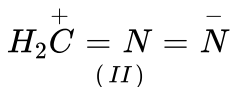
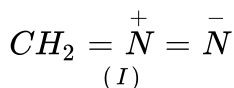


Answer: D



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68. Arrange the following resonating structures in order of increasing stability



A. (I)gt(II)gt(IV)gt(III)

B. (I)gt(III)gt(II)gt(IV)

C. (II)gt(I)gt(III)gt(IV)

D. (III)gt(I)gt(IV)gt(II)

Answer: B



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69. The species having pyramidal shape is

A. SO_3

B. BrF_3

C. SiO_3^{2-}

D. OSF_2

Answer: D



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70. Assuming that Hund's rule is violated the bond order and magnetic nature of the diatomic molecule B_2 is

- A. 1 and diamagnetic
- B. 0 and diamagnetic
- C. 1 and paramagnetic
- D. 0 and paramagnetic

Answer: A



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71. Which one of the following molecules is expected to exhibit diamagnetic behaviour?

- (i) N_2 (ii) O_2
- (iii) S_2 (iv) C_2

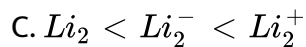
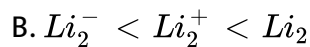
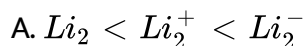
A. C_2



Answer: A::B

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72. Stability of the species Li_2 , Li_2^- and Li_2^+ increases in the order of



Answer: B

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73. Which of the following properties is not shown by NO ?

- A. It is a diamagnetic in gaseous state
- B. It is a neutral oxide
- C. It combines with oxygen to form nitrogen dioxide
- D. Its bond order is 2.5

Answer: A

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74. Assuming $2s - 2p$ mixing is *NOT* operative, the paramagnetic species among the following is .

- A. Be_2
- B. B_2
- C. C_2
- D. N_2

Answer: C



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75. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is

- A. Ion-ion interaction
- B. Ion-dipole interaction
- C. London force
- D. Hydrogen bond

Answer: B



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76. Which of the following species is not paramagnetic?

A. CO

B. O_2

C. B_2

D. NO

Answer: A



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77. Which of the following are Lewis acids?

A. $AlCl_3$ and $SiCl_4$

B. PH_3 and $SiCl_4$

C. BCl_3 and $AlCl_3$

D. PH_3 and BCl_3

Answer: C



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78. Total number of lone pair of electrons in $3 I_3^-$ ion is

A. 6

B. 9

C. 12

D. 3

Answer: B



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79. According to molecular orbital theory, which of the following will not be a viable molecule?

A. He_2^+

B. H_2^-

C. h_2^{2-}

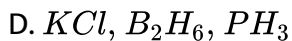
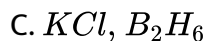
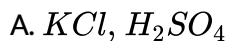
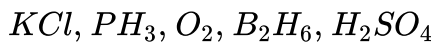


Answer: C



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80. Which of the following compounds contain(s) no covalent bond(s)?

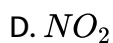
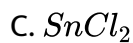
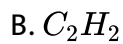
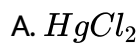


Answer: B



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1. CO_2 is isostructural with

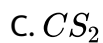
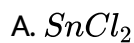


Answer: A::B



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2. The linear structure is assumed by :



Answer: B::C::D

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3. Which of the following have identical bond order?



Answer: A::C

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4. The molecule that will have dipole moment is:



B. Trans-2-pentene

C. Cis-3-Hexene

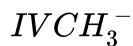
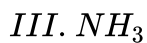
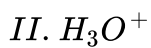
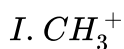
D. 2,2,3,3-tetramethylbutane

Answer: B::C



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5. Pick out the isoelectronic structure from the following



A. I and II

B. III and IV

C. I and III

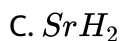
D. II, III and IV

Answer: B::D



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6. Which of the following hydrides are ionic



Answer: A::B::C



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7. CO_3^{2-} anion has which of the following characteristics

A. Bonds of unequal length

B. sp^2 hybridization of C atom

C. Resonance stabilization

D. Same bond angles

Answer: B::C::D



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8. Which of the following conducts electricity in the fused state

A. $BeCl_2$

B. $MgCl_2$

C. $SrCl_2$

D. $BaCl_2$

Answer: B::C::D



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9. Hydrogen bonding plays a central role in which of the following phenomena?

A. Ice floats in water

B. Higher Lewis basicity of primary amines than tertiary amines in aqueous solution

C. Formic acid is more acidic than acetic acid

D.

Answer: A::B::D

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10. According to Molecular Orbital Theory,

A. C_2^{2-} is expected to be diamagnetic

B. O_2^{2+} expected to have a longer bond length than O_2

C. N_2^+ and N_2^- have the same bond order

D. He_2^+ has the same energy as two isolated He atoms

Answer: A::C

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11. Which of the following process is/are associated with change of hybridisation of the underlined compounds?

A. Al(OH)₃ ppt. dissolved in NaOH

B. B₂H₆ is dissolved in THF

C. SiF₄ vapour is passed through liq. HF

D. Solidification of PCl₅ vapour

Answer: A::C::D

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12. Which of the following statements are not correct

A. All C-O bonds in CO_3^{2-} are equal but not in H_2CO_3

B. All C-O bonds in HCO_2^- are equal but not in HCO_2H

C. C-O bond length in HCO_2^- is longer than C-O bond length in CO_3^{2-}

D. C-O bond length in HCO_2^- and C-O bond length in CO_3^{2-} are equal

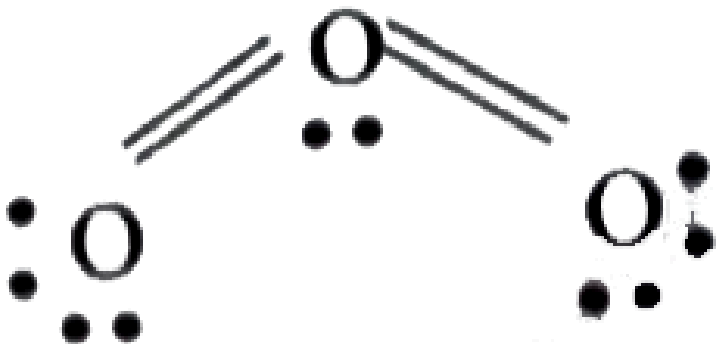
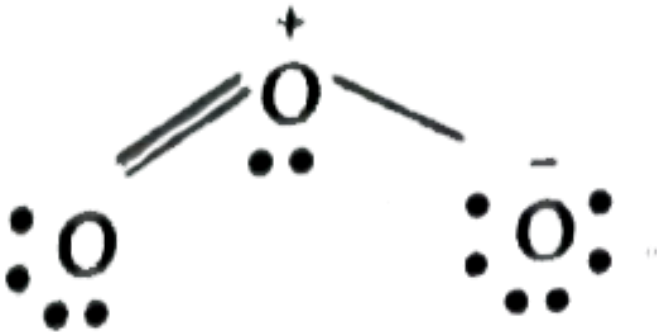
Answer: C::D



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JEE Section (Reasoning type question)

1. Statement I The electronic structure of O_3 is



Statement II

structure is not allowed because octet around O cannot be expanded.

A. Statement 1: is true, statement 2 is true : statement 2 is a correct

explanation for statement 1

B. Statement 1 is true, statement 2 is true , statement 2 is not a

correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: B

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2. Statement 1: $N_2F_3^+$ is planar at each nitrogen atom

Statement 2: In N_2H , the bond angle H-N-H is 120° and bond the N-N bond length are not equal

A. Statement 1: is true, statement 2 is true : statement 2 is a correct explanation for statement 2

B. Statement 1 is true, statement 2 is true , statement 2 is not a correct explanation for statement 2

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: C



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3. Assertion : Carbon has unique ability to form $p\pi - p\pi$ multiple bonds with itself and with other atomic of small size and high electronegativity.

Reason : Heavier elements of group 14th do not form $p\pi - p\pi$ bonds because their atomic orbital are too large and diffuse to have effective sideways overlapping.

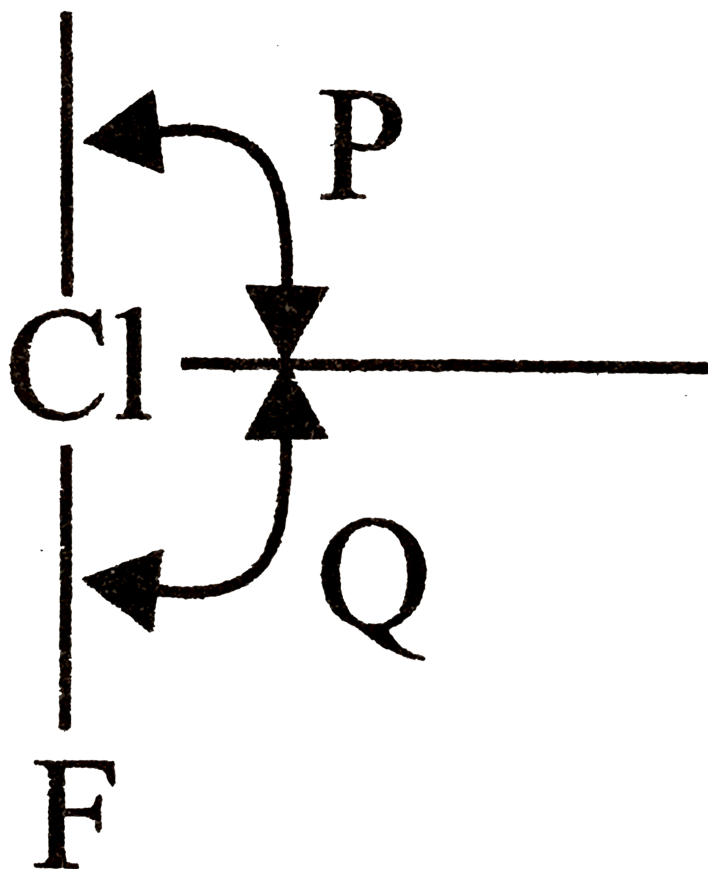
A. Statement 1: is true, statement 2 is true : statement 2 is a correct explanation for statement 3

B. Statement 1 is true, statement 2 is true , statement 2 is not a correct explanation for statement 3

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: B



4. Assertion :

F bond angle p is equal to the bond angle Q but not precisely equal to 90° .

Reason :The molecule is T- shapes and there is repulsion between lone pairs of electrons.

- A. Statement 1: is true, statement 2 is true : statement 2 is a correct explanation for statement 4
- B. Statement 1 is true, statement 2 is true , statement 2 is not a correct explanation for statement 4
- C. Statement 1 is true, statement 2 is false
- D. Statement 1 is false, statement 2 is true

Answer: A

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JEE Section (Comprehension type question)

1. According to MOT, two atomic orbitals overlap resulting in the formation of molecular orbital formed. Number of atomic orbitals overlapping together is equal to the molecule orbital formed. The two atomic orbital thus formed by LCAO (linear combination of atomic

orbital) in the phase or in the different phase are known as bonding and antibonding molecular orbitals respectively. The energy of bonding molecular orbital is lower than that of the pure atomic orbitals by an amount Δ . This known as the stabilization energy. The energy of antibonding molecular orbital is increased by Δ' (destabilisation energy).

Q. How many nodal plane is present in $\sigma_{s \text{ and } p}$ bonding molecular orbital ?

A. Zero

B. 1

C. 2

D. 3

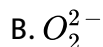
Answer: A



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2. According to MOT, two atomic orbitals overlap resulting in the formation of molecular orbital. Number of atomic orbitals overlapping together is equal to the molecular orbital formed. The two atomic orbitals formed by LCAO (linear combination of atomic orbital) in the same phase or in the different phase are known as bonding and antibonding molecular orbitals respectively. The energy of bonding molecular orbital is less than that of the pure atomic orbital by an amount Δ . This is known as the stabilization energy. The energy of antibonding molecular orbital is increased by ' Δ ' (destabilisation energy)

The bond order of N_2^- is equal to that of



D. None

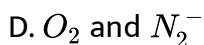
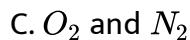
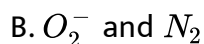
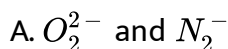
Answer: C



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3. According to MOT, two atomic orbitals overlap resulting in the formation of molecular orbital. Number of atomic orbitals overlapping together is equal to the molecular orbital formed. The two atomic orbitals formed by LCAO (linear combination of atomic orbital) in the same phase or in the different phase are known as bonding and antibonding molecular orbitals respectively. The energy of bonding molecular orbital is less than that of the pure atomic orbital by an amount Δ . This is known as the stabilization energy. The energy of antibonding molecular orbital is increased by ' Δ ' (destabilisation energy)

Which among the following pairs contain both paramagnetic species



Answer: D



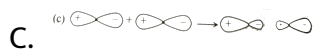
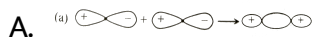
4. Which of the following statement (s) is true

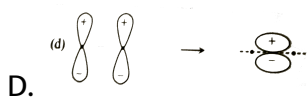
- A. Higher the bond order lesser the bond length
- B. Higher the bond order greater the bond length
- C. Higher the bond order lesser the bond energy
- D. Higher the bond order lesser the number of bonds

Answer: A

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5. Which of the following combination of orbitals is correct





Answer: C

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6. Which of the following statements is not regarding bonding molecular orbitals

- A. Bonding molecular orbitals possess less energy than the atomic orbitals from which they are formed
- B. Bonding molecular orbitals have low electron density between the two nuclei
- C. Electron in bonding molecular orbital contributes to the attraction between atoms
- D. They are formed when the lobes of the combining atomic orbitals have the same sign

Answer: B

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

A. $s + p_z$

B. $P_x + P_y$

C. $P_z + P_z$

D. $P_x + P_x$

Answer: C

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JEE Section (Integer type question)

1. Based on VSEPR theory, the number of $90^\circ F - Br - F$ angles in BrF_5 is

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2. A list of species having the formula of XZ_4 is given below XeF_4 , SF_4 , SiF_4 , BF_4^- , BrF_4^- , $[Cu(NH_3)_4]^{2+}$, $[FeCl_4]^{2-}$, $[CoCl_4]^{2-}$ and $[PtCl_4]^{2-}$

Defining shape on the basis of the locatiion of X and Z atoms, the total number of species having a square planar shape is

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3. The total number of lone pair of electrons in N_2O_3 is

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4. Among the triatomic molecules/ions $BeCl_2$, N_3^- , N_2O , NO_2^+ , O_3 , SCl_2 , ICl_2^- , I_3^- and XeF_2 , the total number of linear molecules (s)/ion(s) where the hybridisation of the central atom does not have contribution from the d - orbitals (s) is [atomic number of $S = 16$, $Cl = 17$, $I = 53$ and $Xe = 54$]

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5. Among H_2 , He_2^+ , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2^- and F_2 , the number of diamagnetic species is

(Atomic numbers:

$H = 1$, $He = 2$, $Li = 3$, $Be = 4$, $B = 5$, $C = 6$, $N = 7$, $O = 8$, $F = 9$)

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6. This section contains some integer type question

The ratio of σ to π bonds in mesitylene is

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7. Diatomic molecule has a dipole moment of $1.2D$ If its bond 1.0\AA what fraction of an electronic charge exists on each atom ? .

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8. This section contains some integer type question

Estimate the percent ionic character of the HBr molecule, given that the dipole moment (μ) is 0.63 D and HBr bond length 187.5 pm

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JEE Section (Matrix match type question)

1. Match each of the diatomic molecules in Column I with its property/properties in Column II.

Column I





Column II

- (A) B_2
- (B) N_2
- (C) O_2^-
- (D) O_2

- (p) Paramagnetic
- (q) Undergoes oxidation
- (r) Undergoes reduction
- (s) Bond order ≥ 2
- (t) Mixing of 's' and 'p' orbitals

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2. Match the orbital overlap figures shown in Column I with the description given in Column II and select the correct answer using the codes given below the Columns.

	Column I		Column II
A.		1.	$p-d \pi$ antibonding
B.		2.	$d-d \sigma$ bonding
C.		3.	$p-d\pi$ bonding
D.		4.	$d-d \sigma$ antibonding

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3. Match the compounds listed in Column I with their relevant characteristics listed in Column II

Column I

- (A) B_2H_6
(B) Al_2Cl_6
(C) $BeCl_2 (s)$
(D) $(SiH_3)_3 N$

Column II

- (p) Tetrahedral hybridisation
(q) Trigonal planar hybridisation
(r) Empty orbital(s) of central atom participate in hybridisation
(s) Two types of bonds
(t) Two types of bond angles

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4. Match the compounds listed in column I with their relevant characteristics listed in Column II

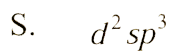
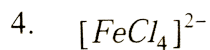
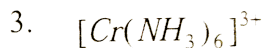
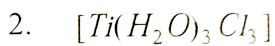
Column I	Column II
(A) Chloral hydrate	(p) Forms a zig-zag chain in both solid and also in the liquid
(B) Hydrogen fluoride	(q) Forms two dimensional sheet with almost hexagonal symmetry
(C) Crystalline boric acid	(r) London dispersion force
(D) Sulphuric acid	(s) Intramolecular H-bond
	(t) Intermolecular H-bond



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JEE Section (Jee (advanced) 2018)

1. Match each set of hybrid orbitals from List -I with complex (es) given in List-II

List – I**List – II****Watch Video Solution**