

Class: XI
Subject: Chemistry
Topic: Chemical Bonding and Molecular Structure
No. of Questions: 27

Q1. Which of the following bonds is the most stable?

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

Right Answer Explanation: A

The more closer are the shells to the nucleus, more will be the overlapping and the stability.

Q2. Which of the following bonds are present in dry ice?

- A. Ionic bonds
- B. Covalent bonds
- C. Hydrogen bonds
- D. None of the above

Right Answer Explanation: B

Dry ice is solid CO_2 , which has C - O covalent bond.

Q3. Which structure will the compounds formed by sp^3d hybridisation have in the absence of a lone pair?

- A. Planar
- B. Pyramidal
- C. Angular
- D. Trigonal bi pyramidal

Right Answer Explanation: D

In the absence of a lone pair, sp^3d hybridisation gives trigonal bi pyramidal geometry.

Q4. Which of the following is least ionic?

- A. AgCl
- B. KCl
- C. BaCl₂
- D. NaCl

Right Answer Explanation: A

Alkali and alkaline earth metal salts are strongly ionic. AgCl is not an alkali or alkaline earth metal salt.

Therefore, it is least ionic.

Q5. Which of the following forces between atoms or ions or molecules is the strongest?

- A. Ionic bond
- B. Ion-dipole
- C. Dipole-dipole
- D. London dispersive

Right Answer Explanation: A

Ionic bonding is strong among these all

Q6. How many electrons are needed by Phosphorus to attain the configuration of nearest noble gas?

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

Right Answer Explanation: D

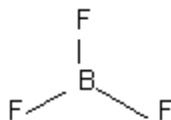
Phosphorus has electronic configuration as $1s^2 2s^2 2p^6 3s^2 3p^3$. It needs three electrons to attain stable noble gas configuration of argon.

Q7. _____ is an electron deficient molecule.

- A. CCl_4
- B. PCl_5
- C. BF_3
- D. SF_6

Right Answer Explanation: C

The compounds in which central atom has less than 8 electrons in their valence shell are electron deficient compounds.



Boron (central atom) has 6 electrons in valence shell, 3 from boron and one each from three fluorine atoms.

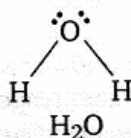
- ∴ Boron in BF_3 has less than 8 electrons.
- ∴ It is electron deficient molecule and is correct answer.

Q8. How many total electron pairs are present in valence shell of oxygen in water molecule?

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

Right Answer Explanation: A

Draw structure of H_2O



∴ It has 4 electron pairs-2-bond pair electrons and 2 lone pair electrons.

Q9. Which of the following geometrical configurations corresponds to dsp^2 hybridization?

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

Right Answer Explanation: B

Square planar geometry corresponds to dsp^2 hybridization.

Q10. How many electrons take part in the formation of bond in N_2 ?

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

Right Answer Explanation: A

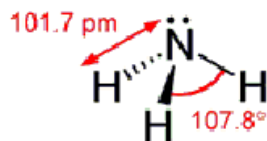
Six electrons take part in the formation of N_2 molecule.

Q11. The numbers of bond pairs and lone pairs in ammonia molecule are _____, respectively.

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

Right Answer Explanation: C

Ammonia or azane is a compound of nitrogen and hydrogen with the formula NH_3 . It is a colourless gas with a characteristic pungent odor. The numbers of bond pairs and lone pairs in ammonia molecule are 3 and 1, respectively.



Q12. Which substance would you expect to have the highest melting point?

- A. NaF
- B. NaCl
- C. NaBr
- D. NaI

Right Answer Explanation: A

NaF is ionic as the high electronegativity difference of sodium and fluorine creates a strong ionic bond between them. That's why it has highest melting point.

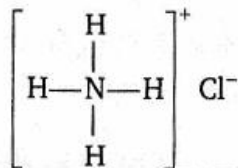
Q13. Which of the following contains both covalent and ionic bonds?

- A. CCl_4
- B. CaCl_2
- C. NH_4Cl
- D. SiCl_4

Right Answer Explanation: C

N forms covalent bonds with hydrogen and ionic bonds with chlorine.

Ammonium chloride contains both covalent and ionic bonds



Q14. Which of the following has the greatest covalent character?

- A. LiCl
- B. NaCl
- C. KCl
- D. RbCl

Right Answer Explanation: A

Smaller the size of cation, higher will be the covalent character of molecule. As the ionic size increases down the group, the correct order of covalent character will be $\text{LiCl} > \text{NaCl} > \text{KCl} > \text{RbCl}$.

Q15. The correct order of bond angles in H_2O , NH_3 , CH_4 and CO_2 is

- A. $\text{H}_2\text{O} > \text{NH}_3 > \text{CO}_2 > \text{CH}_4$
- B. $\text{CH}_4 > \text{CO}_2 > \text{NH}_3 > \text{H}_2\text{O}$
- C. $\text{CO}_2 > \text{CH}_4 > \text{H}_2\text{O} > \text{NH}_3$
- D. $\text{CO}_2 > \text{CH}_4 > \text{NH}_3 > \text{H}_2\text{O}$

Right Answer Explanation: D

Bond angle decreases with increase in the number of lone pairs on the central atoms.

Q16. Which one of the following is a correct set with respect to molecule, hybridisation and shape?

- A. BeCl_2 , sp , linear
 - B. BeCl_2 , sp^2 , trigonal planar
 - C. BCl_3 , sp^2 , trigonal planar
 - D. BCl_3 , sp^3 , tetrahedral
- (i) A and B
(ii) B and C
(iii) C and D
(iv) A and C

Right Answer Explanation: (iv)

BeCl_2 has only 2 bond pair electrons. So, its hybridisation will be sp and structure is linear.

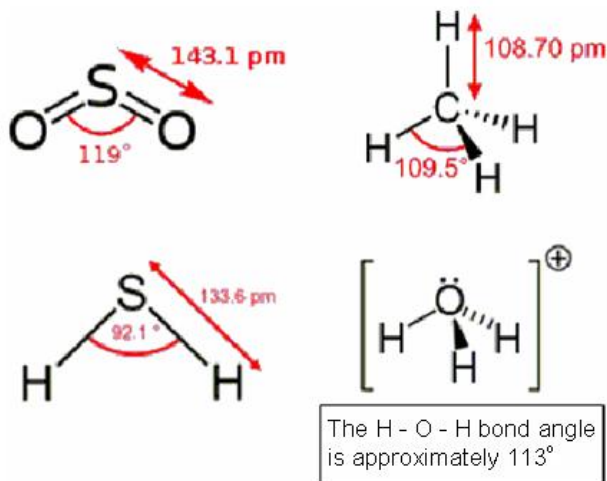
In BCl_3 there is 3 bond pair of electrons. So, its hybridisation is sp^2 and bond angle is 120° and its shape is trigonal planar.

Q17. Which of the following compounds/ions will have the maximum bond angle?

- A. SO_2
- B. CH_4
- C. H_2S
- D. H_3O^+

Right Answer Explanation: A

By looking at the following structure, it is clear that sulphur dioxide will have the maximum bond angle.



Q18. Phosphorus (atomic number 15) and hydrogen elements combine to form a compound whose formula is

- A. P₂H₂
- B. H₂P
- C. PH₃
- D. PH

Right Answer Explanation: C

Phosphorus has three unpaired electrons which will combine with three hydrogen atoms to form PH₃ molecule.

Q19. Which of the following statements about electrovalent substances is false?

- A. Electrovalent substances are made up of ions held together by strong electrostatic forces.
- B. Electrovalent substances have high melting and boiling points.
- C. Electrovalent compounds can conduct electricity in solid state.
- D. None of these

Right Answer Explanation: C

Electrovalent or ionic compounds can conduct electricity only in the molten state. They will not conduct electricity in the solid state.

Q20. Which of the following is not a characteristic of covalent compound?

- A. They are good conductors of electricity.
- B. They are soluble in non polar solvents.
- C. They have low melting and boiling point.
- D. None of these

Right Answer Explanation: A

Electrons are not free in covalent compounds so conduction of electricity is not a property of covalent compounds.

Q21. Write the favourable factors for the formation of ionic bond.

Ans:

An ionic bond is formed by the transfer of one or more electrons from one atom to another. Hence, the formation of ionic bonds depends upon the ease with which neutral atoms can lose or gain electrons. Bond formation also depends upon the lattice energy of the compound formed.

- (i) Low ionization enthalpy of metal atom.
- (ii) High electron gain enthalpy ($\Delta_{eg}H$) of a non-metal atom.
- (iii) High lattice energy of the compound formed.

Q22. Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.

Ans:

The molecular geometry of NH_3 and H_2O can be shown as:



The central atom (N) in NH_3 has one lone pair and there are three bond pairs. In H_2O , there are two lone pairs and two bond pairs.

The two lone pairs present in the oxygen atom of H_2O molecule repel the two bond pairs. This repulsion is stronger than the repulsion between the lone pair and the three bond pairs on the nitrogen atom.

Since the repulsions on the bond pairs in H_2O molecule are greater than that in NH_3 , the bond angle in water is less than of ammonia.

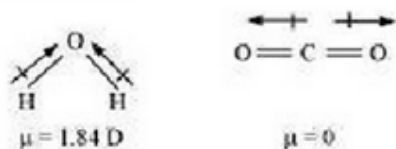
23. Write the significance / applications of dipole moment.

Ans: In heteronuclear molecules, polarization arises due to a difference in the electronegativities of the constituents of atoms. As a result, one end of the molecule acquires a positive charge while the other end becomes negative. Hence, a molecule is said to possess a dipole. The product of the magnitude of the charge and the distance between the centres of positive-negative charges is called the dipole moment (μ) of the molecule. It is a vector quantity and is represented by an arrow with its tail at the positive centre and head pointing towards a negative centre.

Dipole moment (μ) = charge (Q) x distance of separation (r) the SI unit of a dipole moment is 'esu'.

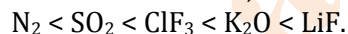
$$1 \text{ esu} = 3.335 \times 10^{-30} \text{ cm}$$

Dipole moment is the measure of the polarity of a bond. It is used to differentiate between polar and non-polar bonds since all non-polar molecules (e.g. H_2 , O_2) have zero dipole moments. It is also helpful in calculating the percentage ionic character of a molecule.



Q24. Arrange the bonds in order of increasing ionic character in the molecules: LiF , K_2O , N_2 , SO_2 and ClF_3 .

Ans: The ionic character in a molecule is dependent upon the electronegativity difference between the constituting atoms. The greater the difference, the greater will be the ionic character of the molecule. On this basis, the order of increasing ionic character in the given molecules is



Q25. Distinguish between a sigma and a pi bond.

Ans: The following are the differences between sigma and pi-bonds:

Sigma (σ) Bond	Pi (π)Bond
(a) It is formed by the end to end overlap of orbitals.	It is formed by the lateral overlap of orbitals.
(b) The orbitals involved in the overlapping are s-s, s-p, or p-p.	These bonds are formed by the overlap of p-p orbitals only.
(c) It is a strong bond.	It is weak bond.
(d) The electron cloud is symmetrical about the line joining the two nuclei.	The electron cloud is not symmetrical.
(e) It consists of one electron cloud, which is symmetrical about the internuclear axis.	There are two electron clouds lying above and below the plane of the atomic nuclei.
(f) Free rotation about σ bonds is possible.	Rotation is restricted in case of pi- bonds.

Q26. Explain the formation of H_2 molecule on the basis of valence bond theory.

Write the important conditions required for the linear combination of atomic orbitals to form molecular orbitals.

Ans: The given conditions should be satisfied by atomic orbitals to form molecular orbitals:

- (i) The combining atomic orbitals must have the same or nearly the same energy. This means that in a homonuclear molecule, the 1s-atomic orbital of an atom can combine with the 1s-atomic orbital of another atom, and not with the 2s-orbital.
- (ii) The combining atomic orbitals must have proper orientation to ensure that the overlap is maximum.
- (iii) The extent of overlapping should be large.

Q27. Write the significance of a plus and a minus sign shown in representing the orbitals.

Ans: Molecular orbitals are represented by wave functions. A plus sign in an orbital indicates a positive wave function while a minus sign in an orbital represents a negative wave function.