

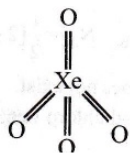
Chemical Bonding and Molecular Structure Important Questions With Answers

NEET Chemistry 2023

1. Which of the following species contains equal number of σ and π -bonds

- a) XeO_4 b) $(\text{CN})_2$ c) $\text{CH}_2(\text{CN})_2$ d) HCO_3^-

Solution : -



Number of σ bonds = 4

Number of π bonds = 4

2. Some of the properties of the two species, NO_3^- and H_2O^+ are described below. Which one of them is correct?

- a) Similar in hybridisation for the central atom with different structures
b) Dissimilar in hybridisation for the central atom with different structures
 c) Isostructural with same hybridisation for the central atom.
 d) Isostructural with different hybridisation for the central atom.

Solution : -

In NO_3^- ,

$$H = \frac{1}{2}[5 + 0 - 0 + 1] = 3, \text{ So, } sp^2 \text{ hybridization.}$$

Thus, it has trigonal planar geometry.

In H_3O^+ ,

$$H = \frac{1}{2}[6 + 3 - 1 + 0] = 4$$

So sp^3 hybridization and it has pyramidal geometry due to the presence of one lone pair of electrons.

3. The canonical or resonating structures of a molecule required to describe the structure of a molecule follow which of the following rules?

- a) The relative position of all atoms can differ.
b) The same number of unpaired and paired electrons in all structures.
 c) The energy of each structure is different. d) Like charges are present on adjacent atoms.

Solution : -

All resonance structures must have the same number of valence electrons.

Electrons are not created or destroyed. You must have as many electrons in the structures that you create as there were in the starting structure.

The same number of unpaired and paired electrons in all structures.

4. H-B-H bond angle in BH_4^- is

- a) 180° b) 120° **c) 109°** d) 90°

Solution : -

H - B - H bond angle in BH_4^- is 109° because it forms the tetrahedral geometry.

5. In a bonded molecule, the order of repulsion between the bonded and non-bonded electrons is

- a) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair
- b) bond pair - bond pair > lone pair - lone pair > lone pair - bond pair
- c) lone pair - lone pair > lone pair - bond pair > bond pair - bond pair**
- d) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair.

Solution : -

Lone pair-lone pair lp-lp repulsions are considered stronger than lone pair-bonding pair lp-bp repulsions, which in turn are considered stronger than bonding pair-bonding pair bp-bp repulsions,

This is because the lone pair of electrons are attracted towards single nuclei only whereas bond pair electrons are attracted towards two nuclei. Thus the strength of the lone pair-lone pair repulsion is supposed to be more than bond pair-bond pair or bond pair-lone pair repulsion.

6. The correct order for bond angles is:

- a) $\text{NO}_2^+ > \text{NO}_2 > \text{NO}_2^-$** b) $\text{NO}_2^+ > \text{NO}_2^- > \text{NO}_2$ c) $\text{NO}_2 > \text{NO}_2^- > \text{NO}_2^+$ d) $\text{NO}_2^- > \text{NO}_2 > \text{NO}_2^+$

Solution : -

NO_2^+ has sp hybridization with no lone pairs on N. NO_2 has sp_2 hybridization with one lone pair on N. So bond angle decreases. NO_2^- has sp_2 hybridization with one unpaired electron on N. So bond angle increases. NO_2 has sp_2 hybridization with no lone pairs on N. Bond angles order is

$\text{NO}_2^+ > \text{NO}_2 > \text{NO}_2^-$

7. The pair in which the two species are isostructural?

- a) SiF_4 and SF_4 b) IO_3^- and XeO_3 **c) BH_4^- and NH_4^+** d) PF_5 and SF_6

Solution : -

$$\text{BH}_4^- = \frac{1}{2}[3+4+1]=4$$

$$\text{NH}_4^+ = \frac{1}{2}[5+4-1]=4$$

8. Which contains both polar and non-polar covalent bonds?

- a) HCN b) CO_2 **c) H_2O_2** d) CH_4

Solution : -

H_2O_2 contains both polar and non-polar covalent bonds. In the structure of H_2O_2 , there are 3 sigma bonds, 2 between O and H and one bond is between 2 O atoms. The two bonds between O and H are polar while that between two O atoms are non-polar.

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

- a) Overlapping valence orbitals b) Mobile valence electrons c) Delocalised electrons
- d) Highly directed bonds**

Solution : -

Metallic bond have force of attraction on all sides between the mobile electrons and the positive kernels. Metals having free electrons as a mobile electrons. So, the metallic bond does not have directional property

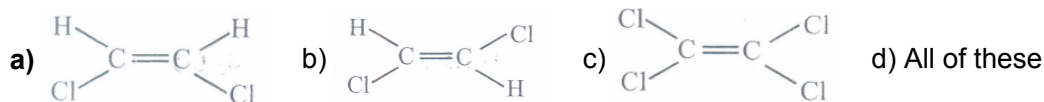
10. According to VSEPR theory,

- a) the shape of the molecule depends upon the bonded electron pairs
- b) pair of electrons attract each other in valence shells
- c) the pairs of electrons tend to occupy such positions that minimise repulsions**
- d) the pairs of electrons tend to occupy such positions that minimise distances from each other.

Solution : -

The pairs of electrons tend to occupy such positions that place them farthest from each other and minimise repulsions.

11. Select the isomers given below, which have non-zero dipole moment ?



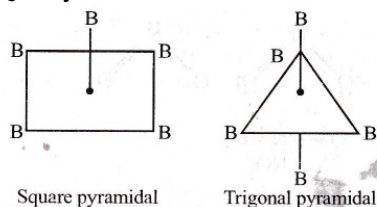
12. Which of the following is not a correct statement?

- a) The canonical structures have no real existence
b) Every AB₅ molecule does in fact have square pyramidal structure
 c) Multiple bonds are always shorter than corresponding single bonds
 d) The electron deficient molecules can act as Lewis acids

Solution : -

Statement (a), (c), (d) are correct. Statement (b) is incorrect statement.

AB₅ may have two structures as follows:

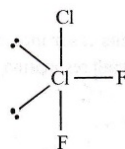


13. In which of the following molecules all the bonds are not equal?

- a) BF₃ b) AlF₃ c) NF₃ **d) ClF₃**

Solution : -

In BF₃, AlF₃ and NF₃ all fluoride atoms are symmetrically oriented concerning the central metal atom but in ClF₃, these fluorine atoms are arranged as follows:



According to the above figure two bonds are in the equatorial plane and one bond is in the axial plane.

14. **Assertion:** In the formation of water molecule, both hydrogen and oxygen atoms attain an octet of electrons.

Reason: Oxygen atom forms two ionic or electrovalent bonds with two hydrogen atoms.

- a) If both assertion and reason are true and reason is the correct explanation of assertion.
 b) If both assertion and reason are true but reason is not the correct explanation of assertion.
 c) If assertion is true but reason is false **d) If both assertion and reason are false.**

Solution : -

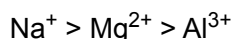
In the formation of water molecule, oxygen atom forms covalent bonds with each hydrogen atom by sharing electrons so as to complete the duplet of hydrogen atom and octet of oxygen atom.

15. Arrange the following in increasing order of covalent character - NaCl, MgCl₂, AlCl₃.

- a) NaCl < MgCl₂ < AlCl₃** b) MgCl₂ < NaCl < AlCl₃ c) AlCl₃ < MgCl₂ < NaCl d) NaCl < AlCl₃ < MgCl₂

Solution : -

Cation size is decreasing in the order:



Al³⁺ has maximum polarisation effect and Na⁺ has minimum polarisation effect.

The covalent nature is in the order:



16. In which of the following pair both the species have sp³ hybridisation?

- a) H₂S, BF₃ b) SiF₄, BeH₂ **c) NF₃, H₂O** d) NF₃, BF₃

Solution : -

According to VSEPR theory both NF₃ and H₂O are sp³ hybridized.

17. If the electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^2$, the four electrons involved in chemical bond formation will be _____.

- a) $3p^6$ b) $3p^6, 4s^2$ c) $3p^6, 3d^2$ d) **$3d^2, 4s^2$**

Solution : -

Electrons from outermost shells ns and $(n - 1)d$ take part in bond formation for transition elements.

18. What will be the bond order of the species with electronic configuration $1s^2 2s^2 2p^5$?

- a) **One** b) Two c) Three d) Zero

Solution : -

Formula to calculate bond order:-

$$\frac{\text{Number of electrons in BMO} - \text{Number of electrons in ABMO}}{2}$$

fill the electrons and we will get 1 bond order with 9 electrons.

19. In NO_3^- ion, the number of bond pair and lone pair of electrons on nitrogen atom is:

- a) 2,2 b) 3,1 c) 1,3 d) **4,0**

Solution : -

Nitrogen has zero lone pair and 4 bond pairs in NO_3^- .

In NO_3^- ion,

Due to the presence of one negative charge, the number of valence electrons = $5 + 1 = 6$.

There are 2σ bonds, 1π bond, and 1 coordinate bond (in which both electrons come from the same atom).

Nitrogen forms a coordinate bond with Oxygen as it cannot have 5 bonds. Although 2 electrons are shared in a coordinate bond, the number of bond pairs is taken to be 1.

The number of bond pairs (or shared pairs) = 4.

The number of lone pairs = 0.

20. **Assertion:** Octet rule is based upon the chemical inertness of noble gases.

Reason: Octet rule can explain the shape and relative stability of the molecule.

- a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) **If assertion is true but reason is false.** d) If both assertion and reason are false.

Solution : -

Octet rule does not account for the shape of molecules and does not explain the relative stability of the molecules being totally silent about the energy of a molecule.

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

- a) $\text{O}_2^- < \text{NO} < \text{C}_2^{2+} < \text{He}_2^+$ b) $\text{NO} < \text{C}_2^{2-} < \text{O}_2^- < \text{He}_2^+$ c) $\text{C}_2^{2-} < \text{He}_2^+ < \text{NO} < \text{O}_2^-$
d) **$\text{He}_2^+ < \text{O}_2^- < \text{NO} < \text{C}_2^{2-}$**

Solution : -

Electronic configuration of $\text{O}_2^- = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_z^2 < \pi 2p_x^2 \pi = \pi 2p_y^2 \pi < 2p_x^2 \pi^* = 2p_y^1 \pi^*$

Bond order = $\frac{1}{2} [10 - 7] = 1.5$

Electronic configuration of $\text{NO} = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_z^2 < \pi 2p_x^2 = \pi 2p_y^2 < \pi^* 2p_x^1 = 2p_y^0$

Bond order = $\frac{1}{2} [10 - 5] = 2.5$

Electronic configuration of $\text{C}_2^{2-} = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2 = \pi 2p_y^2 < \sigma 2p_z^2$

Bond order = $\frac{1}{2} [10 - 4] = 3$

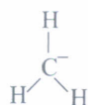
Electronic configuration of $\text{He}_2^+ = \sigma 1s^2 < \sigma^* 1s^1$

Bond order = $\frac{1}{2} [2 - 1] = 0.5$

22. Which of the following does not contain coordinate covalent bond?

- a) NH_4^+ b) H_3O^+ c) **CH_3^-** d) $[\text{Ag}(\text{CN})_2]^+$

Solution : -



23. A molecule which cannot exist theoretically is:

- a) SF₄ b) OF₂ **c) OF₄** d) O₂F₂

Solution : -

In OF₄' O.S. of oxygen is +4. But oxygen can't exhibit +4 O.S.

24. The electronic configuration of four atoms are given in brackets:

L (1s²2s²2p¹); M (1s²2s²2p⁵);

Q (1s²2s²2p⁶3s¹); R (1s²2s²2p²);

The element that would most readily form a diatomic molecule is

- a) Q **b) M** c) R d) L

Solution : -

From the electronic configuration given it is clear that element M is 1 short of octet configuration. It belongs to group 17. Group 17 elements exist as diatomic molecules.

25. Bond order of 1.5 is shown by

- a) O₂⁺ **b) O₂⁻** c) O₂²⁻ d) O₂

Solution : -

Bond order of O₂ = $\frac{1}{2}[10 - 6] = 2$

Bond order of O₂⁺ = $\frac{1}{2}[10 - 5] = 2.5$

Bond order of O₂⁻ = $\frac{1}{2}[10 - 7] = 1.5$

Bond order of O₂²⁻ = $\frac{1}{2}[10 - 8] = 1$

Thus, O₂⁻ has the bond order of 1.5.

26. Which of the following orbitals will not form sigma bond after overlapping?

- a) s-orbital and s-orbital b) s-orbital and p_z-orbital c) p_z-orbital and p_z-orbital **d) p_x-orbital and p_x-orbital**

Solution : -

S and P_z orbitals are along the axis, they are able to form the sigma bond while P_x and P_y orbitals are lateral, so they can form only Pi bond.

Examples of p-p overlapping:- Cl₂, Br₂, I₂

27. Among the three isomers of nitrophenols, the one that is least soluble in water is _____.

- a) o-nitrophenol** b) m-nitrophenol c) p-nitrophenol d) O-nitrophenol and p-nitrophenol

Solution : -

Among the three isomers of nitrophenols, the one that is least soluble in water is o-nitrophenol due to formation of intramolecular hydrogen bonds. m-nitrophenol and p-nitrophenol form hydrogen bonds with water. Hence, they are more soluble.

28. When two atoms of chlorine combine to form one molecule of chlorine gas, the energy of the molecule is

- a) greater than that of separate atoms b) equal to that of separate atoms
c) lower than that of separate atoms d) none of these

Solution : -

The energy of the molecule is less than that of a separate atom because the Cl₂ molecule is more stable than the Cl atom.

Cl atom is more reactive and it has more energy and less stability. It combines with other Cl atom to form Cl₂ which has less energy and more stability than an individual atom.

29. In which of the following solvents KBr be soluble at 25°C? (D is the Dielectric constant)?

- a) C_6H_6 [D=0] b) CH_3COCH_3 [D=2] c) CCl_4 [D=0] d) **CH_3OH [D=32]**

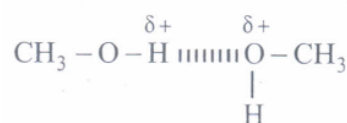
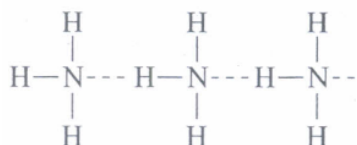
Solution : -

Like dissolves like. Since KBr is a polar ionic compound, it will be soluble in a polar solvent. The solvent with a higher value of dielectric constant will provide maximum solubility. It will be most soluble in polar solvents, i.e. with the highest value of D.

30. Among liq. $(HF)_3$, liq NH_3 , CH_4 , CH_3OH and N_2O_4 , intermolecular hydrogen bond is expected in

- a) **Three molecules** b) Two molecules only c) All the molecules d) All except one

Solution : -

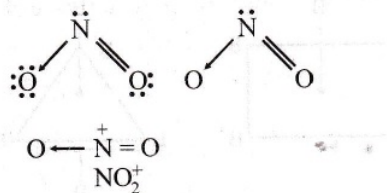


31. The correct order of increasing bond angles in the following triatomic species is:

- a) $NO_2^- < NO_2^+ < NO_2$ b) $NO_2^- < NO_2 < NO_2^+$ c) $NO_2^+ < NO_2 < NO_2^-$
d) $NO_2^+ < NO_2^- < NO$

Solution : -

From the structure of three species we can determine the number of lone pair electrons on central atom (i.e., N atom) and thus the bond angle



We know that higher the number of lone pair of electron on central atom, greater is the 1p -1p repulsion between Nitrogen and Oxygen atoms.

The correct order of bond angle is

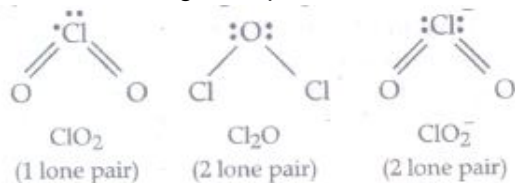


32. The correct order of increasing bond angles in the following species is :

- a) $Cl_2O < ClO_2 < ClO_2^-$ b) $ClO_2 < Cl_2O < ClO_2^-$ c) **$Cl_2O < ClO_2^- < ClO_2$** d) $ClO_2^- < Cl_2O < ClO_2$

Solution : -

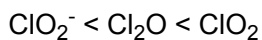
Structure of the given species are as follows :



As ClO_2 has only one lone pair of electrons thus due to lower lone pair-bond pair it has highest bond angle than Cl_2O and ClO_2^- which has two lone pairs of electrons.

Now, among Cl_2O and ClO_2^- , greater bond angle is for Cl_2O due to higher electronegativity of oxygen than

chlorine. As electronegativity of central atom increases the bond pair of electrons are more closer to it and hence more repulsion between them to give a larger bond angle. Thus, the order of increasing bond angle is



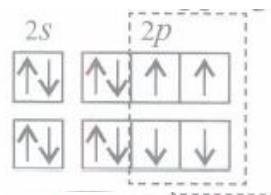
33. Oxygen molecule is formed by

- a) one axial s-s overlap and one p-p axial overlap b) two p-p axial overlaps c) two p-p sidewise overlaps
d) one p-p axial and one p-p sidewise overlap.

Solution : -

Configuration of O atom

Configuration of another O atom



Configuration of O₂ molecule



σ bond of O = O is formed by axial overlapping of p - p orbital while π bond is formed by sidewise overlapping of p - p orbital.

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

- a) **CH₃Cl** b) CH₂Cl₂ c) CHCl₃ d) CCl₄

Solution : -

CH₃Cl has a greater dipole moment because of the CH₃⁻ is a strong electron donor. The atoms are in a tetrahedron with the carbon in the centre. The electronegativity of the chlorine creates the dipole and three of them create a greater net force.

$$\mu_{\text{CCl}_4} = 0, \mu_{\text{CHCl}_3} = 1.0D, \mu_{\text{CH}_2\text{Cl}_2} = 1.6D, \mu_{\text{CH}_3\text{Cl}} = 1.86D$$

CH₃Cl has the highest dipole moment.

35. In a diatomic molecule the bond distance is 1×10^{-8} cm. Its dipole moment is 1.2 D. What is the fractional electronic charge on each atom?

- a) 0.50 b) 1.2×10^{-10} **c) 0.25** d) 1.2

Solution : -

$$\text{Partial charge} = \frac{\text{Dipole moment}}{\text{Bond distance}}$$

$$= \frac{1.2 \times 10^{-18} \text{ esucm}}{1 \times 10^{-8} \text{ cm}} = 1.2 \times 10^{-10} \text{ esu}$$

$$\text{Fractional charge} = \frac{1.2 \times 10^{-10}}{4.8 \times 10^{-10}} = 0.25$$

(4.8×10^{-10} is a theoretical value of μ)

36. Consider the molecules CH₄, NH₃ and H₂O. Which of the given statements is false

a)

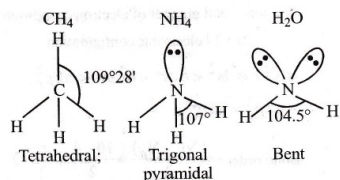
The H-C-H bond angle in CH₄, the H-N-H bond angle in NH₃, and the H-O-H bond angle in H₂O are all greater than 90°.

b) The H-O-H bond angle in H₂O is larger than the H-C-H bond angle in NH₃.

c) The H-O-H bond angle in H₂O is smaller than the H-N-H bond angle in NH₃.

d) The H-C-H bond angle in CH₄ is larger than the H-N-H bond angle in NH₃.

Solution : -



The geometry of H₂O should have been tetrahedral if there are all bond pairs. But due to presence of two lone pairs the shape is distorted tetrahedral. Hence bond angle reduced to 104.5° from 109.5°.

37. Regarding hybridisation the correct statement is

- a) Orbitals of different atoms hybridize b) The angle between any two hybrid orbitals is not the same
c) Hybrid orbitals always form sigma bonds d) Only electrons undergo hybridisation and no orbitals

Solution : -

All hybridized orbitals undergoes head on overlapping and form only sigma bonds

38. **Assertion:** The dipole moment in case of BeF₂ is zero.

Reason: The two equal bond dipoles point in opposite directions and cancel the effect of each other.

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

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

c) If assertion is true but reason is false. d) If both assertion and reason are false.

Solution : -

The dipole moment in BeF₂ is given as shown in the image,

So the assertion and reason are correct.

39. The correct order of increasing covalent character of the following is:

- a) SiCl₄ < AlCl₃ < CaCl₂ < KCl **b) KCl < CaCl₂ < AlCl₃ < SiCl₄** c) AlCl₃ < CaCl₂ < KCl < SiCl₄
 d) none of these

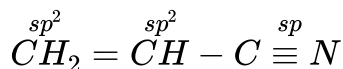
Solution : -

The covalent character of ionic compound can be determined by Fajans rules, the cation with higher positive charge has greater covalent character than cation with lower positive charge in this SiCl₄ having more covalent character. Hence the order of increasing covalent character is: KCl < CaCl₂ < AlCl₃ < SiCl₄

40. Which type of hybridisation is shown by carbon atoms from left to right in the given compound: CH₂=CH-C≡N?

- a) sp², sp², sp** b) Sp², sp, sp c) sp, Sp², Sp³ d) Sp³, Sp², sp

Solution : -

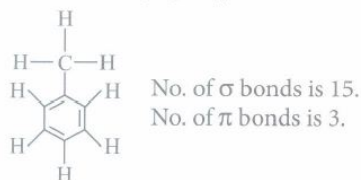


41. How many sigma and pi bonds are present in toluene?

- a) 10σ and 3π bonds b) 12σ and 3π bonds **c) 15σ and 3π bonds** d) 6σ and 3π bonds

Solution : -

Toluene is C₆H₅CH₃



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

- a) SO₂ **b) NO₂⁺** c) O₃ d) NO₂⁻

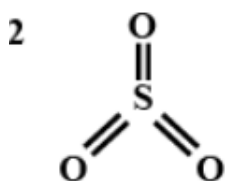
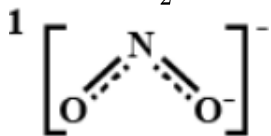
Solution : -

NO_2^- shape is (Image 1)-bent shape

SO_2 shape is (Image 2)-pyramidal shape

NO_2^+ shape is $[\text{O} = \text{N} = \text{O}]^+$ -linear shape

Hence NO_2^+ has a linear shape



43. Linear combination of two hybridized orbitals belonging to the two atoms, each having one electron leads to a :
- a) **Sigma bond** b) Double bond c) Coordinate bond d) Pi-bond

Solution : -

When each orbital contains only one electron then these two electrons occupy bonding orbital to form sigma bond.

44. Strongest hydrogen bond is shown by :

a) **Water** b) Ammonia c) Hydrogen fluoride d) Hydrogen sulphide

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

a) **Hydrogen bonding interactions** b) dipole-dipole interactions c) dipole-induced dipole interactions
d) Induced dipole-induced dipole interactions

Solution : -

Water molecule due to presence of hydrogen atom attached to electronegative oxygen atom shows hydrogen bonding between their molecules. When it exists in liquid state then their molecules are close to each other but when it condenses to ice then the water molecules are not too close and it has open structure having large spaces between the water molecules thus, the density of ice is less than that of liquid water.

46. Match the bond enthalpies given in column II with the molecules given in column I and mark the appropriate choice.

Column I	Column II
(A) Hydrogen (H_2)	(i) 498.0 kJ mol^{-1}
(B) Oxygen (O_2)	(ii) 946.0 kJ mol^{-1}
(C) Nitrogen (N_2)	(iii) 435.8 kJ mol^{-1}

a) (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii) b) (A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (i) c) (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii)
d) **(A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii)**

Solution : -

The order of bond enthalpies of the bonds is given as, Bond order \propto Bond enthalpy Hence, single bond enthalpy < double bond enthalpy < triple bond enthalpy
 $\text{H} - \text{H} < \text{O} = \text{O} < \text{N} \equiv \text{N}$

47. Bond angle in the following conversions decreases except when:

a) NH_4^+ into NH_3 b) **NH_2^- into N_3^-** c) SO_3 into SO_2 d) CO_2 into CO_3^{2-}

Solution : -

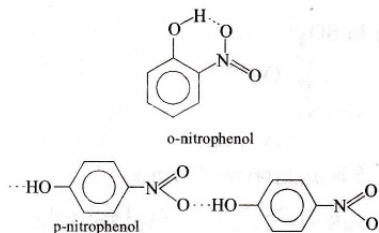
(-) NH_2^- is bent shaped while N_3^- is linear.

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

- a) NO₂ group at p-position behave in a different way from that at o-position
- b) intramolecular hydrogen bonding exists in p-nitrophenol
- c) there is intermolecular hydrogen bonding in p-nitrophenol**
- d) p-nitrophenol has a higher molecular weight than o-nitrophenol

Solution : -

The boiling point of p-nitrophenol is higher than that of o-nitrophenol because p-nitrophenol have intermolecular hydrogen bonding wheieas o-nitrophenol have intramolecular H-bondmg as given below



49. Which of the following statements is not true?

- a) Intermolecular hydrogen bonds are formed between two different molecules of compounds.
- b) Intramolecular hydrogen bonds are formed between two different molecules of the same compound.**
- c) Intramolecular hydrogen bonds are formed within the same molecule.
- d) Hydrogen bonds have strong influence on the physical properties of a compound.

Solution : -

Intramolecular hydrogen bonds are formed within the same molecule.

50. According to molecular orbital theory which of the following lists rank the nitrogen species in terms of increasing bond order?

- a) $N_2^- < N_2 < N_2^{2-}$ **b) $N_2^{2-} < N_2^- < N_2$** c) $N_2 < N_2^{2-} < N_2^-$ d) $N_2^- < N_2^{2-} < N_2$

Solution : -

Electronic configuration of $N_2 = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2 = \pi 2p_y^2 < \sigma 2p_z^2$

Bond order = $\frac{1}{2} [10 - 4] = 3$

Electronic configuration of $N_2^- = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2 = \pi 2p_y^2 < \sigma 2p_z^2 \pi^* < 2p_x^1 \pi^* = 2p_y^0 \pi^*$

Bond order = $\frac{1}{2} [10 - 5] = 2.5$

Electronic configuration of $N_2^{2-} = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2 = \pi 2p_y^2 < \sigma 2p_z^2 \pi^* < 2p_x^1 \pi^* = 2p_y^1 \pi^*$

Bond order = $\frac{1}{2} [10 - 6] = 2$

Hence, the increasing bond order is

$N_2^{2-} < N_2^- < N_2$