CHEMICAL BONDING

1. Which of the following are isostructural pairs ?

A. SO_4^{2-} and CrO_4^{2-}

B. $SiCl_4$ and $TiCl_4$

C. NH_3 and NO_3^-

D. BCl_3 and $BrCl_3$

(1) C and D only

(2) A and B only

(3) A and C only

(4) B and C only

2. Out of the following, which type of interaction is responsible for the stabilisation of α-helix structure of proteins ?

(1) Ionic bonding

(2) Hydrogen bonding

(3) Covalent bonding

(4) vander Waals forces

3. Number of amphoteric compound among the following is _____

(A) BeO (B) BaO

(C) $Be(OH)_2$ (D) $Sr(OH)_2$

4. The correct shape and I–I–I bond angles respectively in I_3^- ion are :-

(1) Distorted trigonal planar; 135° and 90°

(2) T-shaped; 180° and 90°

(3) Trigonal planar; 120°

(4) Linear; 180°

5. The correct set from the following in which both pairs are in correct order of melting point is :-

(1) LiF > LiCl ; MgO > NaCl

(2) LiCl > LiF ; NaCl > MgO

(3) LiF > LiCl ; NaCl > MgO

(4) LiCl > LiF ; MgO > NaCl

6. Among the following allotropic forms of sulphur, the number of allotropic forms, which will show paramagnetism is _____.

(A) α-sulphur (B) β-sulphur

(C) S_2-form

7. According to molecular theory, the species among the following that does not exist is:

(1) He_2^+ (2) He_2^-

(3) Be_2 (4) O_2^{2-}

8. The correct statement about B_2H_6 is:

(1) Terminal B–H bonds have less p-character when compared to bridging bonds.

(2) The two B–H–B bonds are not of same length

(3) All B–H–B angles are of 120°

(4) Its fragment, BH_3, behaves as a Lewis base

9. Among the following, the number of halide(s) which is/are inert to hydrolysis is _____.

(A) BF_3 (B) $SiCl_4$

(C) PCl_5 (D) SF_6

10. Which among the following species has unequal bond lengths ?

(1) BF_4^- (2) XeF_4 (3) SF_4 (4) SiF_4

11. The correct order of bond dissociation enthalpy of halogens is :

(1) $Cl_2 > F_2 > Br_2 > I_2$

(2) $I_2 > Br_2 > Cl_2 > F_2$

(3) $Cl_2 > Br_2 > F_2 > I_2$

(4) $F_2 > Cl_2 > Br_2 > I_2$

12. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Dipole-dipole interactions are the only non-covalent interactions, resulting in hydrogen bond formation.

Reason R : Fluorine is the most electronegative element and hydrogen bonds in HF are symmetrical.

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) A is false but R is true

(2) Both A and R are true and R is the correct explanation of A

(3) A is true R is false

(4) Both A and R are true but R is NOT the correct explanation of A

13. Given below are two statements :
Statement I : o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding.
Statement II : o-Nitrophenol has high melting due to hydrogen bonding.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Statement I is false but Statement II is true
(2) Both statement I and statement II are true
(3) Both statement I and statement II are false
(4) Statement I is true but statement II is false

14. Given below are two statements :one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : In $T\ell I_3$, isomorphous to CsI_3, the metal is present in +1 oxidation state.

Reason R : $T\ell$ metal has fourteen f electrons in the electronic configuration.

In the light of the above statements, choose the most appropriate answer from the options given below:
(1) **A** is correct but **R** is not correct
(2) Both **A** and **R** are correct and **R** is the correct explanation of **A**.
(3) **A** is not correct but **R** is correct
(4) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**.

15. Match List-I with List-II.

List-I (Molecule)	**List-II (Bond order)**
(a) Ne_2	(i) 1
(b) N_2	(ii) 2
(c) F_2	(iii) 0
(d) O_2	(iv) 3

Choose the correct answer from the options given below :
(1) (a)→(iii), (b)→(iv), (c)→(i), (d)→(ii)
(2) (a)→(i), (b)→(ii), (c)→(iii), (d)→(iv)
(3) (a)→(ii), (b)→(i), (c)→(iv), (d)→(iii)
(4) (a)→(iv), (b)→(iii), (c)→(ii), (d)→(i)

16. Match List-I with List-II :

List-I		**List-II**
	Name of oxo acid	Oxidation state of 'P'
(a)	Hypophosphorous acid	(i) +5
(b)	Orthophosphoric acid	(ii) +4
(c)	Hypophosphoric acid	(iii) +3
(d)	Orthophosphorous acid	(iv) +2
		(v) +1

Choose the correct answer from the options given below :
(1) (a)-(v), (b)-(i), (c)-(ii), (d)-(iii)
(2) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
(3) (a)-(iv), (b)-(v), (c)-(ii), (d)-(iii)
(4) (a)-(v), (b)-(iv), (c)-(ii), (d)-(iii)

17. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : The H–O–H bond angle in water molecule is 104.5^o.

Reason R : The lone pair – lone pair repulsion of electrons is higher than the bond pair - bond pair repulsion.
(1) A is false but R is true
(2) Both A and R are true, but R is not the correct explanation of A
(3) A is true but R is false
(4) Both A and R are true, and R is the correct explanation of A

18. The INCORRECT statement regarding the structure of C_{60} is :
(1) The six-membered rings are fused to both six and five-membered rings.
(2) Each carbon atom forms three sigma bonds.
(3) The five-membered rings are fused only to six-membered rings.
(4) It contains 12 six-membered rings and 24 five-membered rings.

19. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is:

(1) see-saw (2) planar triangular

(3) T-shaped (4) trigonal pyramidal

20. Which of the following compound CANNOT act as a Lewis base?

(1) NF_3 (2) PCl_5 (3) SF_4 (4) ClF_3

21. Amongst the following, the linear species is :

(1) NO_2 (2) Cl_2O (3) O_3 (4) N_3^-

22. AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on Molecular orbital theory, the bond order of AX is 25. The total number of electrons in AX is _____. (Round off to the Nearest Integer).

23. The number of species below that have two lone pairs of electrons in their central atom is ____(Round off to the Nearest integer)

SF_4, BF_4^-, ClF_3, AsF_3, PCl_5, BrF_5, XeF_4, SF_6

24. A xenon compound 'A' upon partial hydrolysis gives XeO_2F_2. The number of lone pair of electrons present in compound A is _____(Round off to the Nearest integer)

25. The number of lone pairs of electrons on the central I atom in I_3^- is _____.

26. The hybridisations of the atomic orbitals of nitrogen in NO_2^-, NO_2^+ and NH_4^+ respectively are.

(1) sp^3, sp^2 and sp (2) sp, sp^2 and sp^3

(3) sp^3, sp and sp^2 (4) sp^2, sp and sp^3

27. Match **List-I** with **List-II** :

List-I (Species)		**List-II (Hybrid Orbitals)**
(a) SF_4	(i)	sp^3d^2
(b) IF_5	(ii)	d^2sp^3
(c) NO_2^+	(iii)	sp^3d
(d) NH_4^+	(iv)	sp^3
	(v)	sp

Choose the **correct** answer from the options given below :

(1) (a)-(i), (b)-(ii), (c)-(v) and (d)-(iii)

(2) (a)-(ii), (b)-(i), (c)-(iv) and (d)-(v)

(3) (a)-(iii), (b)-(i), (c)-(v) and (d)-(iv)

(4) (a)-(iv), (b)-(iii), (c)-(ii) and (d)-(v)

28. The number of sigma bonds in

$H_3C - \underset{\displaystyle H}{\underset{|}{C}} = CH - C \equiv C - H$ is _____ .

29. In the following the correct bond order sequence is:

(1) $O_2^{2-} > O_2^+ > O_2^- > O_2$

(2) $O_2^+ > O_2^- > O_2^{2-} > O_2$

(3) $O_2^+ > O_2 > O_2^- > O_2^{2-}$

(4) $O_2 > O_2^- > O_2^{2-} > O_2^+$

30. Identify the species having one π-bond and maximum number of canonical forms from the following :

(1) SO_3 (2) O_2 (3) SO_2 (4) CO_3^{2-}

31. The oxidation states of 'P' in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$, respectively, are :

(1) 7, 5 and 6 (2) 5, 4 and 3

(3) 5, 3 and 4 (4) 6, 4 and 5

32. Given below are two statements : One is labelled as **Assertion A** and the other labelled as **Reason R.**

Assertion A : Lithium halides are some what covalent in nature.

Reason R : Lithium possess high polarisation capability.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) **A** is true but **R** is false

(2) **A** is false but **R** is true

(3) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

(4) Both **A** and **R** are true and **R** is the correct explanation of **A**

33. In gaseous triethyl amine the "–C–N–C–" bond angle is _____ degree.

34. The difference between bond orders of CO and $NO^{\oplus}$ is $\frac{x}{2}$ where x = _____.

(Round off to the Nearest Integer)

35. Number of Cl=O bonds in chlorous acid, chloric acid and perchloric acid respectively are

(1) 3, 1 and 1

(2) 4, 1 and 0

(3) 1, 1 and 3

(4) 1, 2 and 3

36. The total number of electrons in all bonding molecular orbitals of O_2^{2-} is ..... .

(Round off to the nearest integer)

37. AB_3 is an interhalogen T-shaped molecule. The number of lone pairs of electrons on A is _____. (Integer answer)

38. The interaction energy of London forces between two particles is proportional to r^x, where r is the distance between the particles. The value of x is :

(1) 3 (2) –3

(3) –6 (4) 6

39. The number of non-ionisable hydrogen atoms present in the final product obtained from the hydrolysis of PCl_5 is :

(1) 0 (2) 2

(3) 1 (4) 3

40. The bond order and magnetic behaviour of O_2^- ion are, respectively :

(1) 1.5 and paramagnetic

(2) 1.5 and diamagnetic

(3) 2 and diamagnetic

(4) 1 and paramagnetic

41. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Barium carbonate is insoluble in water and is highly stable.

Reason (R) : The thermal stability of the carbonates increases with increasing cationic size.

(1) Both **(A)** and **(R)** are true but **(R)** is the true explanation of **(A)**

(2) **(A)** is true but **(R)** is false

(3) Both **(A)** and **(R)** are true and **(R)** is not the true explanation of **(A)**

(4) **(A)** is false but **(R)** is true.

42. Match **List–I** with **List–II** :

List–I (Species)	**List–II (Number of lone pairs of electrons on the central atom)**
(a) XeF_2	(i) 0
(b) XeO_2F_2	(ii) 1
(c) XeO_3F_2	(iii) 2
(d) XeF_4	(iv) 3

Choose the **most appropriate** answer from the options given below :

(1) (a)–(iv), (b)–(i), (c)–(ii), (d)–(iii)

(2) (a)–(iii), (b)–(iv), (c)–(ii), (d)–(i)

(3) (a)–(iii), (b)–(ii), (c)–(iv), (d)–(i)

(4) (a)–(iv), (b)–(ii), (c)–(i), (d)–(iii)

43. In which one of the following molecules strongest back donation of an electron pair from halide to boron is expected?

(1) BCl_3 (2) BF_3

(3) BBr_3 (4) BI_3

44. The number of species having non–pyramidal shape among the following is_____.

(A) SO_3

(B) NO_3^-

(C) PCl_3

(D) CO_3^{2-}

45. The number of hydrogen bonded water molecule(s) associated with stoichiometry $CuSO_4.5H_2O$ is _____.

46. Which one of the following correctly represents the order of stability of oxides, X_2O; (X = halogen) ?

(1) Br > Cl > I

(2) Br > I > Cl

(3) Cl > I > Br

(4) I > Cl > Br

47. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is :

48. Number of paramagnetic oxides among the following given oxides is _____.

Li_2O, CaO, Na_2O_2, KO_2, MgO and K_2O

(1) 1 (2) 2 (3) 3 (4) 0

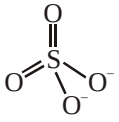
49. The spin-only magnetic moment value of B_2^+ species is _____$\times 10^{-2}$ BM.

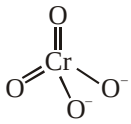
(Nearest integer) *-[Given : $\sqrt{3} = 1.73$]

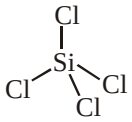
SOLUTION

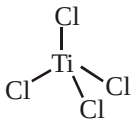
1. Official Ans. by NTA (2)

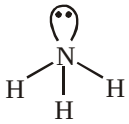
Sol. Isostructural means same structure

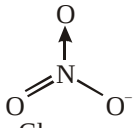
(A) SO_4^{2-}  : Tetrahedral

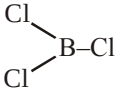
CrO_4^{2-}  : Tetrahedral

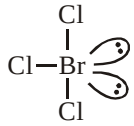
(B) $SiCl_4$  : Tetrahedral

$TiCl_4$  : Tetrahedral

(C) NH_3  : Triagonal pyramidal

NO_3^-  : Triagonal planar

(D) BCl_3  : Triagonal planar

$BrCl_3$  : T-shape

2. Official Ans. by NTA (2)

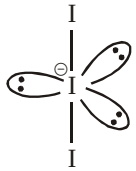
Sol. Hydrogen bonding is responsible for the stacking of α-helix structure of protein.

3. Official Ans. by NTA (2)

Sol. Both compounds BeO and $Be(OH)_2$ are amphoteric in nature.

and both compounds BaO and $Sr(OH)_2$ are basic in nature.

4. Official Ans. by NTA (4)

Sol. 

Shape : Linear, I–I–I Bond angle ⇒ 180°

5. Official Ans. by NTA (1)

Sol. L.E. ∝ M.P.

L.E. : LiF > LiCl, MgO > NaCl

6. Official Ans. by NTA (1)

Sol. α-sulphur and β-sulphur are diamagnetic.

S_2-form is paramagnetic.

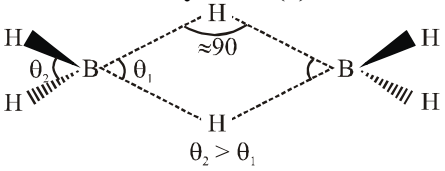
7. Official Ans. by NTA (3)

Sol.

Chemical Species	Bond Order
He_2^+	0.5
He_2^-	0.5
Be_2	0
O_2^{2-}	1

According to M.O.T. If bond order of chemical species is zero then that chemical species does not exist.

8. Official Ans. by NTA (1)

Sol. 

- $\theta_2 > \theta_1$, ∴ B–H (terminal) having less p-character as compare to bridge bond.
- Both B–H–B bridge bond having same bond length.
- B–H–B bond angle is ≈90°
- BH_3 is e^- deficient species and therefore act as lewis acid

9. Official Ans. by NTA (1)

Sol. SF_6 is inert towards hydrolysis

∴ answere is (1)

10. Official Ans. by NTA (3)

Sol.

Species	Hybridisation	Bond length
$BF_4^{\ominus}$	sp^3(Tetrahedral)	All bond lengths equal
XeF_4	sp^3d^2(sq. planar)	All bond lengths equal
SF_4	sp^3d(see – saw)	axial bond length > equitorial bond length
SiF_4	sp^3(Tetrahedral)	all bond lengths equal

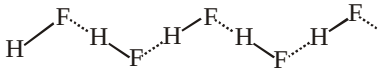
11. Official Ans. by NTA (3)

Sol. Correct order of bond dissociation enthalpy of halogens is $Cl_2 > Br_2 > F_2 > I_2$.

Due to inter electronic repulsions F–F bond becomes weak and easily broken.

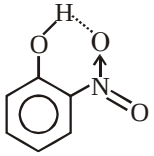
12. Official Ans. by NTA (1)

Sol. Assertion is incorrect since in hydrogen bonding, Dipole–dipole interactions are non-covalent but ion-dipole interaction can also result in H-bond formation. Reason is correct since F is most electronegative element & structure is



Symmetrical H-bonds are present

13. Official Ans. by NTA (4)

Sol.  Intramolecular H–bonding

thus it is more volatile due to intramolecular H-bonding.

Melting point depends on packing efficiency not on H-bonding thus statement II is false

14. Official Ans. by NTA (4)

Sol. $T\ell I_3 \Rightarrow \left(T\ell^{\oplus} \& I_3^{\ominus}\right)$

$CsI_3 \Rightarrow \left(Cs^{\oplus} \& I_3^{\ominus}\right)$

[Both have same crystalline structure is called isomorphous]

$T\ell^{\oplus}_{(81)} = [Xe_{54}]4f^{14}, 5d^{10}, 6s^2$

(It is correct due to present 14 f electrons in $T\ell^{\oplus}$ ion)

15. Official Ans by NTA (1)

Sol. (a) Ne_2 = Total $e^{\ominus}$ = 20

$$\text{B.O.} = \frac{10-10}{2} = 0$$

(b) N_2 = Total $e^{\ominus}$ = 14

$$\text{B.O.} = \frac{10-4}{2} = 3$$

(c) F_2 = Total $e^{\ominus}$ = 18

$$\text{B.O.} = \frac{10-8}{2} = 1$$

(d) O_2 = Total $e^{\ominus}$ = 16

$$\text{B.O.} = \frac{10-6}{2} = 2$$

16. Official Ans. by NTA (1)

Sol. (a) Hypophosphorus acid : $H_3\underline{P}O_2$

(+1) 3 + x + (–2)2 = 0

x = +1

(b) Orthophosphoric acid : $H_3\underline{P}O_4$

(+1) 3 + x + (–2)4 = 0

x = +5

(c) Hypophosphoric acid : $H_4P_2O_6$

(+1) 4 + 2x + (–2)6 = 0

x = +4

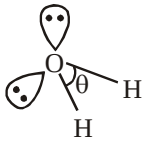
(d) Orthophosphorous acid : $H_3\underline{P}O_3$

(+1)3 + x + (–2)3 = 0

x = +3

17. Official Ans. by NTA (4)

Sol. H_2O



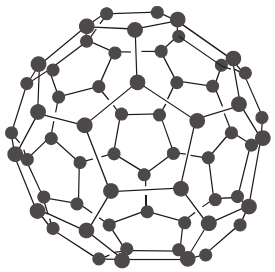
θ = 104.5°

the hybridisation of oxygen is water molecule is sp^3.

So electron geometry of water molecule is tetrahedral and the bond angle should be 109°28" but as we know that lone pair-lone pair repulsion of electrons is higher than the bond pair-bond pair repulsion because lone pair is occupied more space around central atom than that of bond pair.

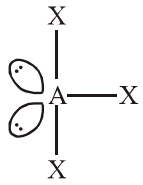
18. Official Ans. by NTA (4)

Sol. Structure of C_{60}



It contain 20 hexagons (20) and 12 pentagons (12) so option 4 is incorrect.

19. Official Ans. by NTA (3)

Sol. 

sp^3d hybridised

T-shaped

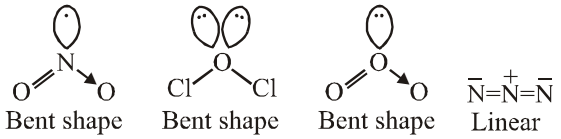
20. Official Ans. by NTA (2)

Sol. Lewis base : Chemical species which has capability to donate electron pair.

In NF_3, SF_4, ClF_3 central atom (i.e. N, S, Cl) having lone pair therefore act as lewis base.

In PCl_5 central atom (P) does not have lone pair therefore does not act as lewis base.

21. Official Ans. by NTA (4)

Sol. 

Bent shape Bent shape Bent shape Linear

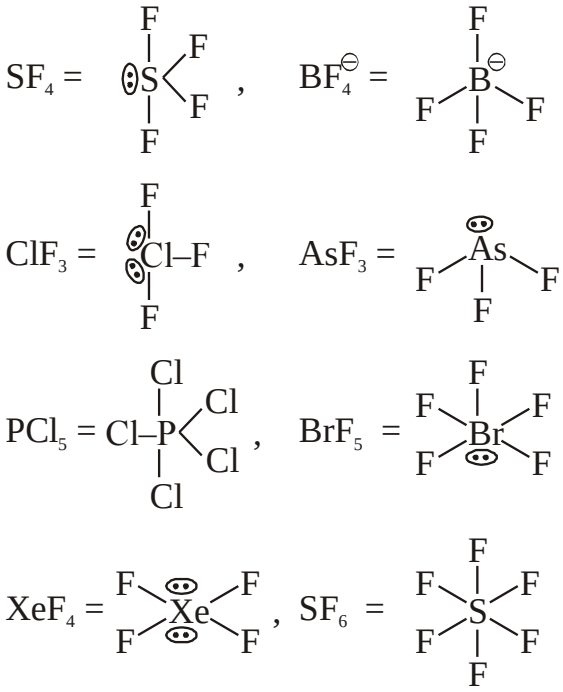
22. Official Ans. by NTA (15)

Sol. AX is a covalent diatomic molecule.

The molecule is NO.

Total no. of electrons is 15.

23. Official Ans. by NTA (2)

Sol. 

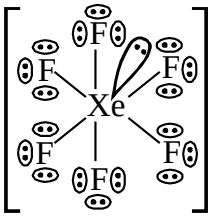
Two l.p. on central atom is = ClF_3, XeF_4

24. Official Ans. by NTA (19)

Sol. $XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$

(A) (Limited water)

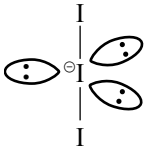
Structure of 'A'



Total l.p. on (A) = 19

25. Official Ans. by NTA (3)

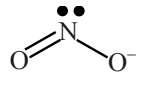
Sol. I_3^- :



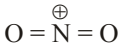
The number of lone pairs of electron on the central atom is 3.

26. Official Ans. by NTA (4)

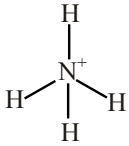
Sol.



$2\sigma + 1$ lp
$\therefore$ sp^2



$2\sigma + 0$ lp
$\therefore$ sp



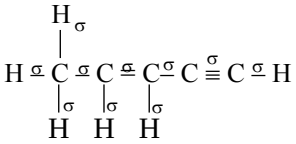
$4\sigma + 0$
$\therefore$ sp^3

27. Official Ans. by NTA (3)

Sol. (a) SF_4 – sp^3d hybridisation
(b) IF_5 – sp^3d^2 hybridisation
(c) NO_2^+ – sp hybridisation
(d) NH_4^+ – sp^3 hybridisation

28. Official Ans. by NTA (10)

Sol.



numbers of σ bonds = 10

29. Official Ans. by NTA (3)

Sol. O_2 (16 electrons)

$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \sigma_{2p_z}^2$

$\pi_{2p_x}^2 = \pi_{2p_y}^2, \pi_{2p_x}^{*1} = \pi_{2p_y}^{*1}, \sigma_{2p_z}^*$

Bond order of $O_2 \Rightarrow 2$

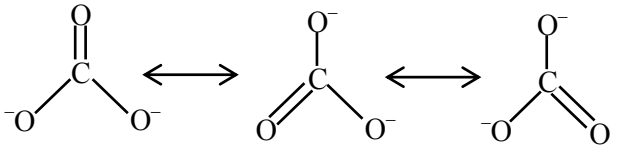
Bond order of $O_2^- \Rightarrow 1.5$

Bond order of $O_2^{2-} \Rightarrow 1$

Bond order of $O_2^+ \Rightarrow 2.5$

30. Official Ans. by NTA (4)

Sol. Among SO_3, O_2, SO_2 and CO_3^{2-}, only O_2 and CO_3^{2-} has only one π-bond



31. Official Ans. by NTA (3)

Sol. Oxidation state of P in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$ is 5, 3 & 4 respectively

$H_4P_2O_7$

$2x + 4(+1) + 7(-2) = 0$

$x = +5$

$H_4\underline{P_2}O_5$

$2x + 4(+1) + 5(-2) = 0$

$x = +3$

$H_4\underline{P_2}O_6$

$2x + 4(+1) + 6(-2) = 0$

$x = +4$

32. Official Ans. by NTA (4)

Sol. Lithium due to small size has very high polarization capability and thus increases covalent nature in Halides.

33. Official Ans. by NTA (108)

Sol. In gaseous triethyl amine the "–C–N–C–" bond angle is 108 degree.

34. Official Ans. by NTA (0)

Sol. Bond order of CO = 3

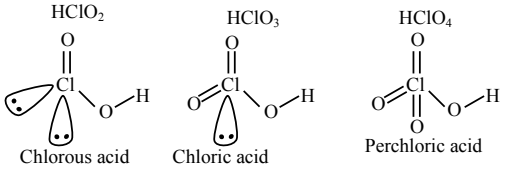
Bond order of NO^+ = 3

Difference = $0 = \frac{x}{2}$

$x = 0$

35. Official Ans. by NTA (4)

Sol. Number of Cl = O bonds



36. Official Ans. by NTA (10)

Sol. M. O. Configuration of O_2^{2-} $(18\bar{e})$

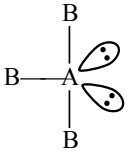
$\sigma 1s^2\, {}^*\sigma 1s^2 \sigma 2s^2\, {}^*\sigma 2s^2 \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2$

${}^*\pi 2p_x^2 = {}^*\pi 2p_y^2$

Total B.M.O electrons = 10

37. Official Ans. by NTA (2)

Sol. T-shaped molecule means 3 sigma bond and 2 lone pairs of electron on central atom.



38. Official Ans. by NTA (3)

Sol. For london dispersion forces.

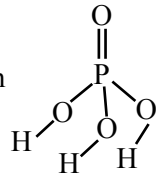
$$E \propto \frac{1}{r^6}$$

Hence x = –6

39. Official Ans. by NTA (1)

Sol. $PCl_5 + H_2O \rightarrow POCl_3 + 2HCl$

$H_3PO_4 + 3HCl$

In  + HCl

all hydrogens are ionisable

$\therefore$ Ans is zero.

40. Official Ans. by NTA (1)

Sol. $O_2^- = (\sigma_{1s})^2(\sigma_{1s}^*)^2(\sigma_{2s})^2(\sigma_{2s}^*)^2(\sigma_{2p_z})^2$

$\left(\pi_{2p_x}^2 = \pi_{2p_y}^2\right)\left(\pi_{2p_x}^{*2} = \pi_{2p_y}^{*1}\right)$

$$\text{Bond order} = \frac{10-7}{2} = 1.5$$

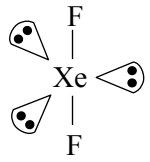
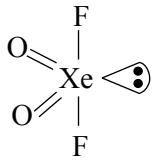
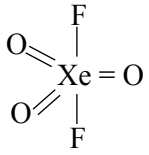
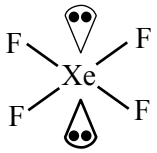
and paramagnetic

41. Official Ans. by NTA (1)

Sol. In IIA group on moving down the group size of cation increases and show thermal stability of carbonate increases.

42. Official Ans. by NTA (4)

Sol. **Species (Number of lone pairs of electrons on the central atom)**

XeF_2	3	
XeO_2F_2	1	
XeO_3F_2	0	
XeF_4	2	

43. Official Ans. by NTA (2)

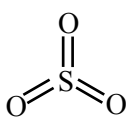
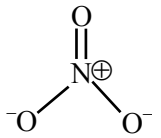
Sol. Type of back bonding

BF_3	BCl	BBr_3	BI_3
(2pπ–2pπ)	(2pπ–3pπ)	(2pπ–4pπ)	(2pπ–5pπ)

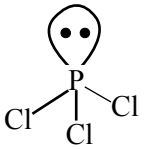
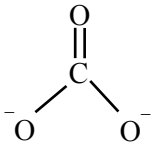
Therefore back bonding strength is as follows

BF_3 > BCl > BBr_3 > BI_3

44. Official Ans. by NTA (3)

Sol.  

Trigonal planar Trigonal planar

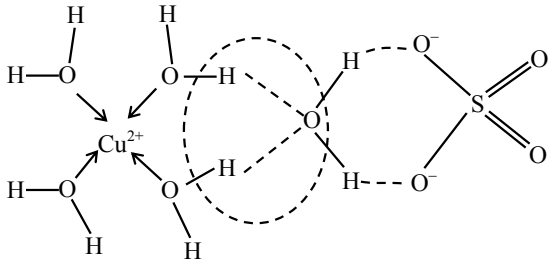
 

Pyramidal Trigonal

Hence non-pyramidal species are SO_3, NO_3^- and CO_3^{2-}.

45. Official Ans. by NTA (1)

Sol.



One hydrogen bonded H_2O molecule

46. Official Ans. by NTA (4)

Sol. Stability of oxides of Halogens is

$I > Cl > Br$

47. Official Ans. by NTA (0)

Sol. Molecular orbital configuration of O_2^{2-} is

$$\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\left(\pi 2p_x^2=\pi 2p_y^2\right)\left(\pi_{2px}^{*2}=\pi_{2py}^{*2}\right)$$

Zero unpaired electron

48. Official Ans. by NTA (1)

Sol. $Li_2O \Rightarrow 2Li^+ \quad O^{2-}$ $\qquad MgO \Rightarrow Mg^{2+} \quad O^{2-}$

$CaO \Rightarrow Ca^{2+} \quad O^{2-}$ $\qquad K_2O \Rightarrow 2K^+ \quad O^{2-}$

$Na_2O_2 \Rightarrow 2Na^+ \quad O_2^{2-}$

$KO_2 \Rightarrow K^+ \quad O_2^-$

$O_2^- \Rightarrow$ Complete octet, diamagnetic

$O^{2-} \Rightarrow \sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \sigma_{2px}^2\ \pi_{2py}^2 \simeq \pi_{2pz}^2\ \pi_{2py}^{*2} \simeq \pi_{2pz}^{*2}$ (dia)

$O_2^- \Rightarrow \sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \sigma_{2px}^2\ \pi_{2py}^2 \simeq \pi_{2pz}^2\ \pi_{2py}^{*2} \simeq \pi_{2pz}^{*1}$

(para)

49. Official Ans. by NTA (173)

Sol. $B_2^+ \Rightarrow \sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s}^2\ \sigma_{2s}^{*2}\ \pi_{2py}^1 \simeq \pi_{2pz}^0$

$\Rightarrow 9e^-$

$\mu = \sqrt{1(1+2)} = \sqrt{3}$ BM

$= 1.73$ BM

$= 1.73 \times 10^{-2}$ BM