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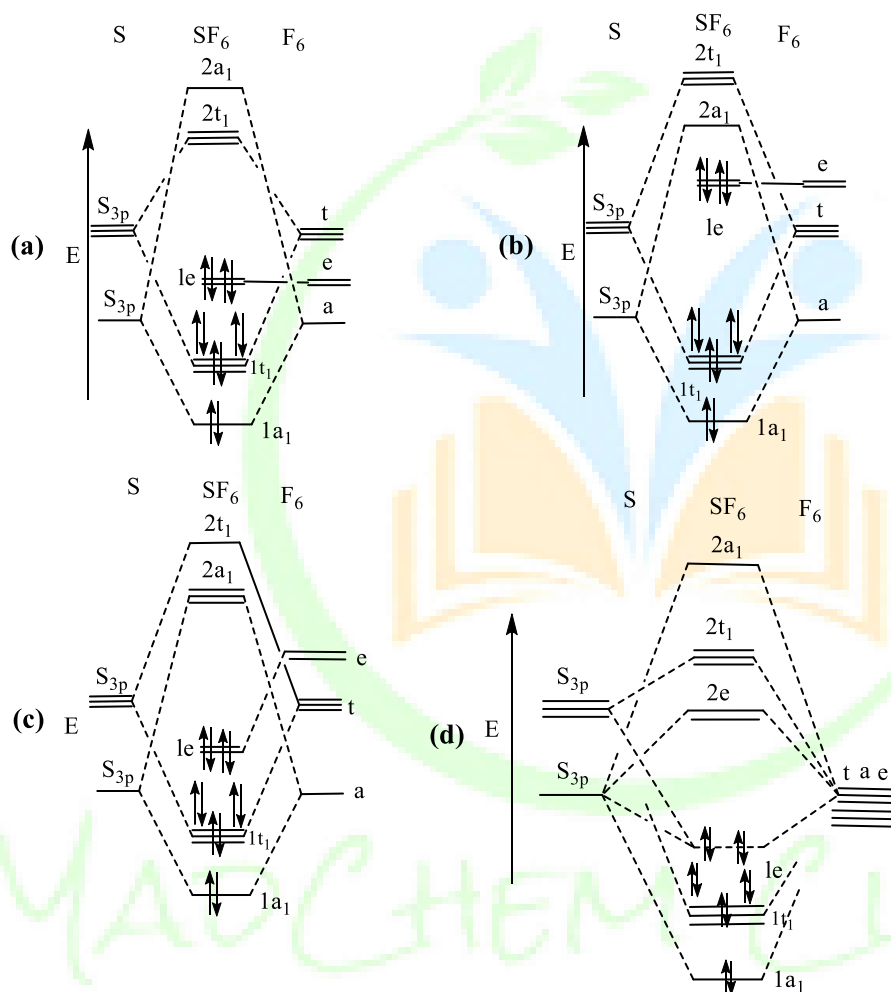


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1. Among Sf_4 , Bf_4^- , Xef_4 , and Iu_4 the number of species having two lone pair of electrons on the central atoms according to VSEPR theory is: [NET JUNE 2011]
 (a) 2 (b) 3 (c) 4 (d) 0
2. In the molecule H_2O , NH_3 and CH_4 [NET JUNE 2011]
 (a) bond angles are same. (b) The bond distance are same.
 (c) The hybridizations are same. (d) The shapes are same
3. According to VSEPR theory, the molecule/ion having ideal tetrahedral shape is: [NET JUNE 2011]
 (a) SF_4 (b) SO_4^{2-} (c) S_2Cl_2 (d) SO_2Cl_2
4. The highest occupied MO in N_2 and O_2^+ respectively are (take x-axis as internuclear axis) [NET JUNE 2011]
 (a) $\sigma 2p_x$, $\pi^* 2p_y$ (b) $\pi 2p_y$, $\pi 2p_z$ (c) $\sigma^* 2p_x$, $\sigma 2p_x$ (d) $\pi^* 2p_y$, $\pi^* 2p_z$
5. The number of antibonding electrons in NO and CO according and the charge for a metal carbonyl complex $M(CO)_x]^{z-}$ that satisfies the 18 electron rule is [NET DEC 2011]
 (a) 1, 0 (b) 2, 2 (c) 3, 2 (d) 2, 3
6. Among the following pairs, those in which both species have similar structures are : [NET DEC 2011]
 (A) N_3^- , XeF_2 (B) $[ICl_4]^-$, $[PtCl_4]^{2-}$ (C) $[ClF_2]^+$, $[ICl_2]^-$ (D) XeO_3 , SO_3
 (a) (A) and (B) only (b) (A) and (C) only
 (c) (A), (B) and (C) only (d) (B), (C) and (D) only
7. Match list I (compounds) with list II (structures), and select the correct answer using the codes given below. [NET DEC 2011]
- | | |
|--------------------------|-----------------------------|
| List-I | List-II |
| (A) XeO_4 | (i) Square planar |
| (B) BrF | (ii) tetrahedral |
| (C) $SeCl_4$ | (iii) distorted tetrahedral |
| (a) (A-ii) (B-iii) (C-i) | (b) (A-iii) (B-i) (C-ii) |
| (c) (A-ii) (B-i) (C-iii) | (d) (A-i) (B-ii) (C-iii) |
8. The total number of lone pairs of electrons in I_3^- is : [NET JUNE 2012]
 (a) Zero (b) Three (c) Six (d) Nine
9. Which of the among CO_3^{2-} , SO_3 , XeO_3 and NO_3^{\ominus} have planar structure ? [NET DEC 2012]
 (a) CO_3^{2-} , SO_3 and XeO_3 (b) SO_3 , XeO_3 and NO_3^-
 (c) CO_3^{2-} , XeO_3 and NO_3^- (d) CO_3^{2-} , SO_3 and NO_3^-
10. The number of lone pairs are identical in the pairs. [NET JUNE 2013]
 (a) XeF_4 , ClF_3 (b) XeO_4 , ICl_4^- (c) XeO_2F_2 , ICl_4^- (d) XeO_4 , ClF_3
11. According to VSEPR theory, the geometry (with lone pair) around the central iodine in I_3^+ and I_3^- ions respectively are [NET Dec 2013]
 (a) tetrahedral and tetrahedral (b) trigonal bipyramidal and trigonal bipyramidal
 (c) tetrahedral and trigonal bipyramidal (d) tetrahedral and octahedral
12. The molecule in which the bond order increases upon addition of an electron is [NET Dec 2013]
 (a) O_2 (b) B_2 (c) P_2 (d) N_2
13. In bis (dimethylglyoximato) nickel (II), the number of Ni-N, Ni-O and intramolecular hydrogen bond(s), respectively are [NET June 2014]
 (a) 4, 0 and 2 (b) 2, 2 and 2 (c) 2, 2 and 0 (d) 4, 0 and 1
14. If L is a neutral monodentate ligand, the species, $[AgL_4]^{2+}$, $[AgL_6]^{2+}$ and $[AgL_4]^{3+}$, respectively are [NET June 2014]
 (a) paramagnetic, paramagnetic and diamagnetic
 (b) paramagnetic, diamagnetic and paramagnetic
 (c) diamagnetic, paramagnetic and diamagnetic



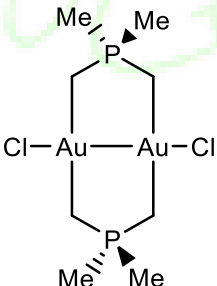
- (d) Paramagnetic, diamagnetic and diamagnetic.
15. Structures of SbPh_5 and PPh_5 respectively are [NET June 2014]
 (a) Trigonal bipyramidal, square pyramidal
 (b) square pyramidal, trigonal bipyramidal
 (c) trigonal bipyramidal, trigonal bipyramidal
 (d) square pyramidal, square pyramidal
16. The δ -bond is formed via the overlap of [NET Dec 2014]
 (a) $d_{x^2 - y^2}$ and $d_{x^2 - y^2}$ orbitals
 (b) d_{xz} and d_{xz} orbitals
 (c) d_{xy} and d_{xy} orbitals
 (d) d_{yz} and d_{yz} orbitals
17. The correct schematic molecular energy diagram for SF_6 molecule is [NET Dec 2014]



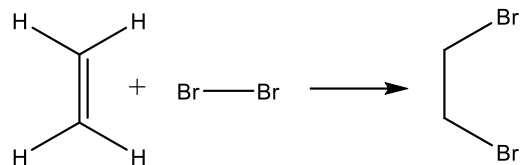
18. For the oxidation state (s) of sulphur atoms in S_2O , consider the following [NET June 2015]
 A. -2 and +4 B. 0 and +2 C. +4 and 0
 The Correct answer(s) is/(are)
 (a) A and B (b) A and C (c) B and C (d) C only
19. The geometries of $[\text{Br}_3]^+$ and $[\text{I}_5]^+$, respectively, are [NET June 2015]
 (a) Trigonal and tetrahedral (b) Tetrahedral and trigonal bipyramidal
 (c) tetrahedral and tetrahedral (d) linear and trigonal pyramidal
20. A molecular orbital of a diatomic molecule changes sign when it is rotated by 180° around the molecular axis. This orbital is [NET June 2015]
 (a) σ (b) π (c) δ (d) ϕ



21. The structures of XeF_2 and XeO_2F_2 respectively are [NET Dec. 2015]
 (a) bent, tetrahedral (b) linear, square planar
 (c) linear, see-saw (d) bent, see-saw
22. The molecule C_3O_2 has a linear structure. This compound has [NET Dec 2015]
 (a) 4σ and 4π bonds (b) 3σ and 2π bonds
 (c) 2σ and 3π bonds (d) 3σ and 4π bonds.
23. The correct statement among the following is [NET Dec 2015]
 (a) N_2 has higher bond order than N_2^+ and hence has larger bond length compared to N_2^+ .
 (b) N_2^+ has higher bond order than N_2 and hence has larger bond length compared to N_2 .
 (c) N_2 has higher bond order than N_2^+ and hence has higher dissociation energy compared to N_2^+
 (d) N_2 has lower bond order than N_2^+ and hence has lower dissociation energy compared to N_2^+
24. The number of lone pair(s) of electrons on the central atom in $[\text{BrF}_4]^-$, XeF_6 and $[\text{SbCl}_6]^{3-}$ are, respectively [NET Dec 2015]
 (a) 2, 0 and 1 (b) 1, 0 and 0 (c) 2, 1 and 1 (d) 2, 1 and 0
25. The ground state electronic configuration of C_2 using all electron is [NET Dec 2015]
 (a) $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p}^2 \pi_{2p}^2$ (b) $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p}^2 \pi_{2p}^{*2}$
 (c) $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^2 \sigma_{2p}^1 \pi_{2p}^{*1}$ (d) $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4$
26. Correct combination for π and π^* orbitals in B_2 molecule is [NET JUNE 2016]

π	π^*
(a) Gerade	Ungerade
(b) Ungerade	Gerade
(c) Gerade	Gerade
(d) Ungerade	Ungerade
27. The correct shape of $[\text{TeF}_5]^-$ ion on the basis of VSEPR theory is [NET June 2015]
 (a) Trigonal bipyramidal (b) Square pyramidal
 (c) pentagonal planar (d) see-saw
28. Choose the correct option for carbonyl fluoride with respect to bond angle and bond length [NET June 2015]
 (a) $\angle\text{F-C-F} > \angle\text{F-C-O}$ and $\text{C-F} > \text{C-O}$ (b) $\angle\text{F-C-F} > \angle\text{F-C-O}$ and $\text{C-F} < \text{C-O}$
 (c) $\angle\text{F-C-F} < \angle\text{F-C-O}$ and $\text{C-F} > \text{C-O}$ (d) $\angle\text{F-C-F} < \angle\text{F-C-O}$ and $\text{C-F} < \text{C-O}$
29. The number of $3c-2e$ bonds present in $\text{Al}(\text{BH}_4)_3$ is [NET June 2015]
 (a) Four (b) Three (c) six (d) zero
30. The oxidation state of gold in the following complex is [NET Dec 2016]

- (a) 0 (b) 1 (c) 2 (d) 3
31. Molecular orbital interactions involved in the first step of the following reaction is [NET Dec 2016]





- (a) $\pi_{C=C} \rightarrow \sigma_{Br-Br}^*$ (b) $n_{Br} \rightarrow \sigma_{C-C}$ (c) $\pi_{C=C} \rightarrow \sigma_{Br-Br}$ (d) $n_{Br} \rightarrow \pi_{C=C}$
32. The geometry of $[ReH_9]^{2-}$ is [NET Dec 2016]
 (a) monocapped square antiprism (b) monocapped cube
 (c) tricapped trigonal prism (d) heptagonal bipyramidal
33. The correct geometry of $[Rh_6C(CO)_{15}]^{2-}$ is [NET Dec 2016]
 (a) octahedron (b) pentagonal pyramid
 (c) trigonal prism (d) monocapped square pyramid
34. The numbers of triangular faces in square antiprism, icosahedron and tricapped trigonal prism (capped on square faces), respectively, are [NET Dec 2016]
 (a) 8, 20 and 14 (b) 8, 20 and 12 (c) 10, 12 and 14 (d) 10, 12 and 12
35. Based on VSEPR theory, the predicted shapes of $[XeF_5]^-$ and BrF_5 respectively, are [NET June 2017]
 (a) pentagonal planar and square pyramidal
 (b) square pyramidal and trigonal bipyramidal
 (c) trigonal bipyramidal and square pyramidal
 (d) square pyramidal and pentagonal planar
36. Among ClO_3^- , XeO_3 and SO_3 , species with pyramidal shape is/are ? [NET Dec 2017]
 (a) ClO_3^- and XeO_3 (b) XeO_3 and SO_3 (c) ClO_3^- and SO_3 (d) SO_3
37. Geometries of SNF_3 and XeF_2O_2 , respectively, are [NET Dec 2017]
 (a) Square planar and square planar (b) tetrahedral and tetrahedral
 (c) square planar and trigonal bipyramidal (d) tetrahedral trigonal bipyramidal
38. The most unstable complex on the basis of electro-neutrality principle among the following is [NET Dec 2017]
 (a) $[Al(OH)_6]^{3+}$ (b) $[Al(NH_3)_6]^{3+}$ (c) $[AlF_6]^{3-}$ (d) $[Al(NCCH_3)_6]^{3+}$
39. Boron in BCl_3 has [NET Dec 2017]
 (a) sp hybridization (b) sp^2 hybridization
 (c) sp^3 hybridization (d) no hybridization
40. According to Bent's rule, for p-block elements, the correct combination of geometry around the central atom and position of more electro-negative substituent is [NET Dec 2017]
 (a) Trigonal bipyramidal and axial (b) Trigonal bipyramidal and equatorial
 (c) Square pyramidal and axial (d) Square pyramidal and basal
41. Dinuclear anion $[I_2(OH)_2O_8]^{4-}$ has two bridging oxo groups. The geometry around each iodine is [NET June 2018]
 (a) Octahedral (b) Monocapped octahedral
 (c) Square pyramidal (d) Pentagonal bipyramidal
42. Removal of an electron from NO molecule results in [NET June 2018]
 A. An increase in the $\nu(NO)$ in the IR spectrum
 B. An EPR active species
 C. Electrons in HOMO s being closer to the oxygen than to nitrogen 2p orbital's
 D. Electron in HOMO s being closer to the nitrogen than to oxygen 2p orbital's
 The correct answer is
 (a) A only (b) A and C (c) B and D (d) A, B and C
43. Consider the nature of solvents in column I and the corresponding λ_{max} for I_2 in various solvents given in



column II. (For I_2 vapor λ_{\max} is 520 nm). Match column I with column II

[NET June 2018]

Column I		Column II (λ_{\max} , nm)	
(a)	Non-donor	(i)	520
(b)	Weak donor	(ii)	500
(c)	Strong donor	(iii)	450
(d)	π electron donor	(iv)	360

- (a) (a)–(i); (b)–(ii); (c)–(iii); (d)–(iv) (b) (a)–(iii); (b)–(iv); (c)–(ii); (d)–(i)
 (c) (a)–(i); (b)–(iii); (c)–(iv); (d)–(ii) (d) (a)–(iv); (b)–(iii); (c)–(ii); (d)–(i)

44. Consider following statements : [NET June 2018]

I. $AsCl_5$ is thermally less stable than PCl_5 .

II. Size of As is more than that of P.

Choose correct answer from the following

- (a) Statements I and II are true and II is the correct explanation of I.
 (b) Statements I and II are true but II is not the correct explanation of I.
 (c) Statement I is true and statement II is false.
 (d) Both the statements I and II are false.

45. Consider the species NO , I_2 , I_2^- , Cu^{2+} and VO^{2+} . The number of paramagnetic species among them and the EPR inactive species, respectively, are [NET Dec 2018]

46. Identify the correct statement(s) for $H_3B \cdot CO$. [NET Dec 2018]

- (A) sp^2 hybridized orbital of B accepts the lone pair of CO.
 (B) Its ν_{CO} value is more than that for Free CO
 (C) Formal oxidation state of C is +4 in the compound

Answer is

- (a) A and B (b) B only (c) A only (d) A and C

47. Among $SiCl_4$, $P(O)Cl_3$, NF_3 , $trans-[SnCl_4(py)_2]$ (py= pyridine), those with zero dipole moment are [NET Dec 2018]

- (a) $SiCl_4$ and NF_3 (b) $SiCl_4$, $P(O)Cl_3$ and $trans-SnCl_4(py)_2$
 (c) $SiCl_4$ and $trans-SnCl_4(py)_2$ (d) NF_3 and $trans-SnCl_4(py)_2$

48. The standard reduction potentials in acid medium for F_2 , Cl_2 , Na and Zn are in the order [NET Dec 2018]

- (a) $F_2 > Cl_2 > Na > Zn$ (b) $F_2 > Cl_2 > Zn > Na$
 (c) $Na > Zn > Cl_2 > F_2$ (d) $Cl_2 > F_2 > Zn > Na$

49. The characters of LUMO and CN^- and O_2 respectively, are [NET Dec 2018]

- (a) σ_g and π_u (b) π_u and σ_u (c) π_g and σ_u (d) σ_u and π_g

50. Arrange the following molecules in order of increasing fundamental vibrational frequencies [NET Dec 2018]

- (a) $O_2^{2-} < O_2^- < O_2 < O_2^+$ (b) $O_2 < O_2^+ < O_2^- < O_2^{2-}$
 (c) $O_2^{2-} < O_2^- < O_2^+ < O_2$ (d) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

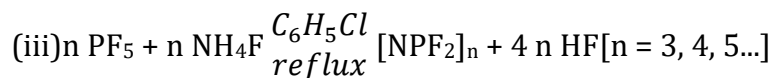
51. O_2^- is [NET June 2019]

- (a) Having a shorter O–O bond length than that in O_2
 (b) a stronger oxidizing agent than O_2
 (c) IR active



- (d) Unable to abstract proton from weak acids.
52. Choose the correct statement(s) among the following [NET June 2019]
 (I) LiF is more soluble than LiClO₄ in water.
 (II) The standard reduction potential [E°] of Li is more negative than that of Na.
 (III) The heat of hydration of Li⁺(g) is greater than that of Na⁺(g)
 (a) I and II (b) I and III (c) II and III (d) III only
53. Match the appropriate geometry on the right with each of the species on the left [NET June 2019]
 (A) FXeO(OSO₂F) (I) linear
 (B) FXeN(SO₂F)₂ (II) pyramidal
 (C) XeO₃ (III) T-shaped
 (D) XeOF₂ (IV) bent
 (a) A-I, B-I, C-II, D-III (b) A-I, B-I, C-II, D-IV
 (c) A-IV, B-I, C-II, D-III (d) A-I, B-IV, C-II, D-III
54. Of the following statements regarding dissociative substitution in an octahedral transition metal complex, [NET NOV 2020]
 (a) High steric hindrance between in the metal complex favors fast dissociation of ligand.
 (b) Increased charge on the metal complex fast dissociation of ligand.
 (c) A pentacoordinated intermediate is observed.
 (d) Nature of the entering ligand significantly influences the reaction.
 Which are correct ?
 (a) a and d (b) a and c (c) a, c and d (d) a, b, c and d
55. Consider an octahedral complex Ma₂b₂cd, where a, b, c and d are monodentate ligands, The number of enantiomeric pairs for the complex is [NET NOV 2020]
 (a) One (b) two (c) three (d) Four
56. The effective magnetic moment (in BM) for a lanthanide f₁₀ ion is approximately [NET NOV 2020]
 (a) 10.6 (b) 9.92 (c) 9.59 (d) 7.94
57. In 3-iron ferredoxins, the number of sulfide bridges and cysteinyl ligands, respectively, are: [NET NOV 2020]
 (a) 3, 3 (b) 4, 3 (c) 3, 4 (d) 4, 4
58. Which of the following statements for rubredoxin, [NET NOV 2020]
 A. Fe²⁺ center has a tetrahedral geometry.
 B. Reduced form of iron is diamagnetic.
 C. Fe²⁺ center undergoes Jahn-Teller distortion.
 D. It is a [2Fe-2S] cluster.
 are correct ?
 (a) A, B and C (b) A, C and D (c) C and D only (d) A and C only
59. Which of the following reaction(s) do(es) NOT occur [NET FEB 2022]
 (i) $[\text{NPCl}_2]_3 + 6\text{NaF} \xrightarrow[\text{reflux}]{\text{MeCN}} [\text{NPF}_2]_3 + 6\text{NaCl}$
 (ii) $n \text{PCl}_5 + n \text{NH}_4\text{Cl} \xrightarrow[\text{reflux}]{\text{C}_6\text{H}_5\text{Cl}} [\text{NPCl}_2]_n + 4n \text{HCl} [n = 3, 4, 5 \dots]$





- (a) (i) and (iii) (b) (i) and (ii) (c) (i) only (d) (iii) only

60. Consider the following statements for the self-exchange electron transfer reaction in $[\text{Cr}(\text{H}_2\text{O})_6]^{2+/3+}$ [NET FEB 2022]

- (a) σ^* orbitals are only involved in electron transfer
 (b) It involves large inner-sphere reorganization energy
 (c) It involves no change in M-L bond lengths
 (d) Rate of self-exchange electron transfer is fast

The correct statements are

- (a) a, b and d (b) a and b (c) a and c (d) b and d

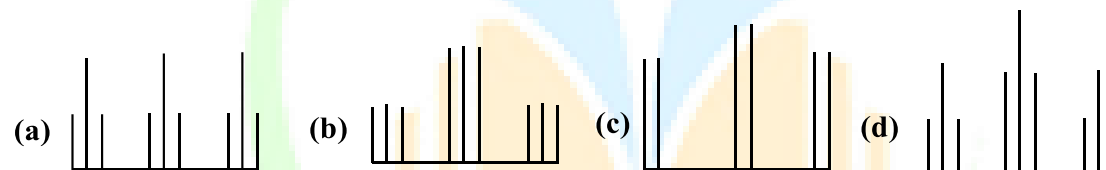
61. Consider following terms. Identify those which are relevant to d.c. polarography [NET FEB 2022]

- A. Thermal current B. Supporting electrolyte C. Depolarization D. Gelatin

Correct answer is

- (a) A, B and C (b) A, B and D (c) B, C and D (d) C and D only

62. Which of the patterns (A, B, C or D) fits best with the ^{13}C NMR spectrum of $\text{TiCl}_3(\text{CDH}_2)$ [Given: $^1\text{J}(\text{C}-\text{H}) > ^1\text{J}(\text{C}-\text{D})$] [NET FEB 2022]



- (a) A (b) B (c) C (d) D

63. The statement(s) that correctly describe(s) the molecular orbital (MO) diagram of HO (hydroxyl radical) is/are (consider the O-H bond to be along the axis)

A. The Highest Occupied Molecular Orbital (HOMO) is a non-bonded MO that is predominantly formed with $2p_z$ and $2p_y$ atomic orbitals (AOs) of O-atom.
 B. The HOMO is σ -bonded MO that is predominantly formed by the overlap of H(1s) and O(2s) AOs.
 C. The σ -bonding MO is formed by the overlap of H(1s) and ($2p_z$) AOs.
 D. The σ -bonding MO is formed by the overlap of H(1s) and O ($2p_x$) AOs. [NET SEP 2022]

- (a) A and C only (b) A and D only (c) B only (d) D only

64. Consider the following pairs of compounds. [NET SEP 2022]

- (i) NH_4Cl and FeO (ii) $\text{H}_3\text{N}\cdot\text{BF}_3$ and BCl_3 (iii) HSO_3F and HF

The more acidic species in (i), (ii) and (iii) are respectively.

- (a) FeO , BCl_3 and HF (b) NH_4Cl , $\text{H}_3\text{N}\cdot\text{BF}_3$, HF
 (c) FeO , $\text{H}_3\text{N}\cdot\text{BF}_3$ and HSO_3F (d) NH_4Cl , BCl_3 and HSO_3F

Acidity – $\text{H}_2\text{SO}_3\text{F} > \text{HF} > \text{H}_2\text{SO}_4 > \text{HCO}_2\text{H} > \text{CH}_3\text{CO}_2\text{H} > \text{CH}_3\text{CH}_2\text{OH} > \text{H}_2\text{O} > \text{DMSO} > \text{NH}_3$.

65. Consider the statements about the following species, ClF , $[\text{ClF}_2]^+$, ClF_3 , $[\text{ClF}_4]^+$ and ClF_5 .

- A. There are 9 lone pairs of electrons on the chlorine atoms in the five species.
 B. The species $[\text{ClF}_4]^+$ has a tetrahedral shape.
 C. The compound $[\text{ClF}_4]^+$ is a very strong fluorinating agent.

The correct statement are:

- (a) B and C only (b) A and C only (c) A and B only (d) A, B and C

66. The correct statement regarding the following physical properties is [NET SEP 2022]

- (a) Bond order follows $\text{Li}_2 < \text{C}_2 < \text{B}_2 < \text{PH}_3 < \text{AsH}_3 < \text{Si} < \text{S}$



- (b) Melting point follows $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{Si} < \text{S}$
 (c) Pauling electronegativity follows $\text{Al} < \text{Si} < \text{S} < \text{P}$ Order.
 (d) First Ionization energy follows $\text{Li} < \text{B} < \text{Be} < \text{C}$ order.
67. In the stratosphere, the radical Cl^\cdot produced from chlorofluorocarbons reacts with O_3 as follows
 $\text{Cl}^\cdot + \text{O}_3 \rightarrow \text{X} + \text{colorless gas}$
 $2\text{X} \rightarrow \text{X}_2$
 $\text{X}_2 \rightarrow \text{Cl}^- + \text{Y}$
 X, Y are respectively [NET SEP 2022]
- (a) ClO^\cdot , $\text{O}=\overset{\cdot}{\text{Cl}}=\text{O}$ (b) ClO^\cdot , $\text{Cl}-\text{O}-\text{O}^\cdot$ (c) $\text{Cl}-\text{O}-\text{O}^\cdot$, O_2 (d) ClO^\cdot , O_2
68. The Geometry around Te in the symmetrical trimeric species of $[\text{TeO}_2\text{F}]^-$ is [NET SEP 2022]
 (a) Square planar (b) Tetrahedral
 (c) Trigonalbipyramidal (d) Octahedral
69. The Ionization energies (IE_1 to IE_5) of 's' and/or 'p' block elements (X, Y and Z) are given below. [NET SEP 2022]

	IE_1 (kJ mol ⁻¹)	IE_2 (kJ mol ⁻¹)	IE_3 (kJ mol ⁻¹)	IE_4 (kJ mol ⁻¹)	IE_5 (kJ mol ⁻¹)
X	1086	2353	4620	6223	37830
Y	800	2427	3060	25030	32830
Z	496	4562	6910	9543	13350

- (a) X=2; Y=3; Z=4 (b) X=4; Y=1; Z=1 (c) X=4; Y=3; Z=1 (d) X=1; Y=3; Z=4

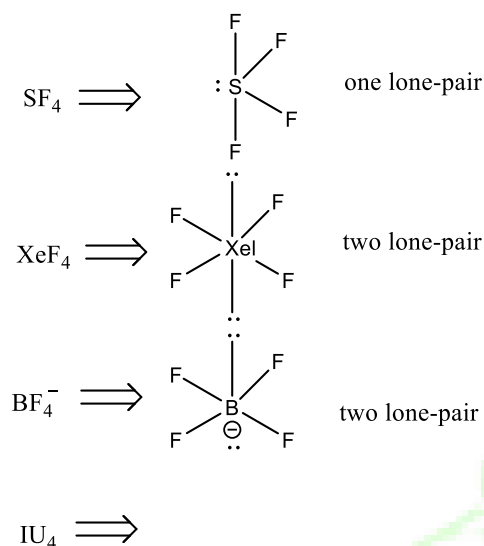
ANSWER KEY

1. A	2. C	3. B	4. A	5. A	6. B	7. C	8. D	9. D	10. A
11. B	12. B	13. A	14. A	15. B	16. A&C	17. A	18. A	19. B	20. B
21. C	22. A	23. C	24. C	25. D	26. B	27. B	28. C	29. C	30. C
31. A	32. A&C	33. C	34. A	35. A	36. A	37. D	38. B	39. B	40. A
41. A	42. B	43. C	44. B	45. B	46. B	47. C	48. B	49. C	50. A
51. B	52. C	53. A	54. B	55. B	56. A	57. C	58. D	59. D	60. A&B
61. C	62. B	63. B	64. D	65. B	66. D	67. B	68. C	69. C	

SOLUTION

1.
 Ans. (a)
 Sol.





2.

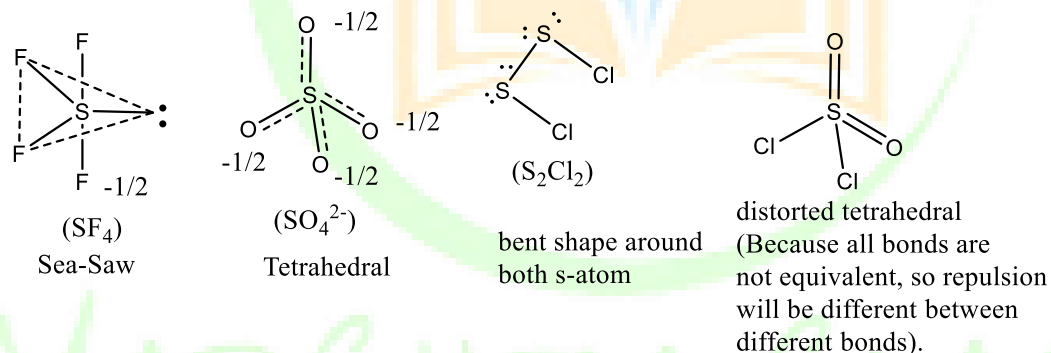
Ans. (c)

Sol. $H_2O \Rightarrow sp^3$ $NH_3 \Rightarrow sp^3$ $CH_4 \Rightarrow sp^3$

3.

Ans. (b)

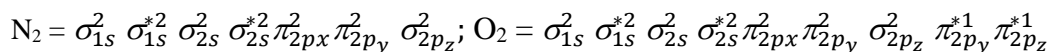
Sol.



4.

Ans. (a)

Sol. X-axis as internuclear axis.



5.

Ans. (a)

Sol. Energy level for NO, $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2px}^2 \pi_{2py}^2 \sigma_{2pz}^{*1}$

Number of electrons in antibonding MO = 1

Energy level for CO, $\sigma_{1nb}^2 \sigma_2^2 \pi_1^2 = \pi_2^2 \sigma_{3nb}^2$

No electron is present in antibonding MO.

So, number of antibonding MO is zero

6.



Ans. (b)

- Sol. (A) $N_3^- \rightarrow$ linear, $XeF_2 \rightarrow$ Linear
 (B) $ClF_2^+ \rightarrow$ Bent, $ICl_2^- \rightarrow$ Linear
 (C) $ICl_4^- \rightarrow$ square planar, $[PtCl_4]^{2-} \rightarrow$ square planar
 (D) $XeO_3 \rightarrow$ Trigonal pyramidal, $SO_3 \rightarrow$ Trigonal planar

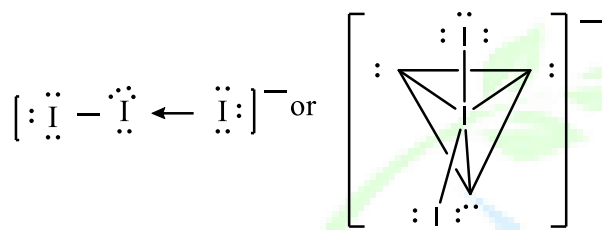
7.

Ans. (c)

8.

Ans. (d)

Sol.

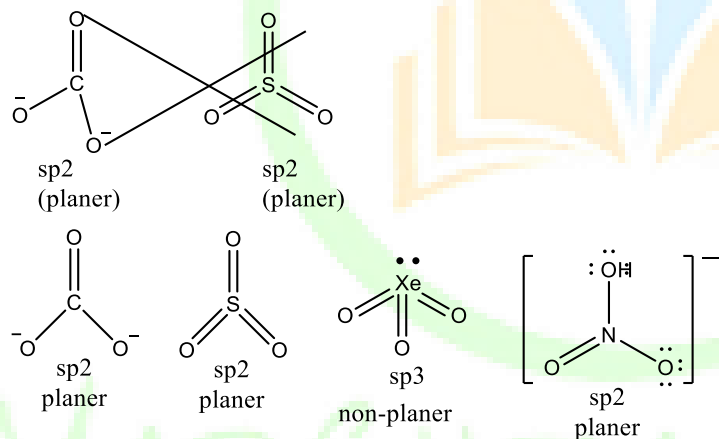


Number of lone pair of electrons = 9

9.

Ans. (d)

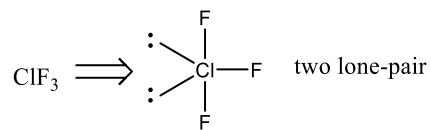
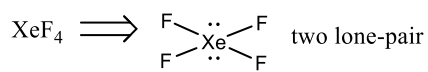
Sol.



10.

Ans. (a)

Sol.



11.

Ans. (b)



Sol. Number of valence electrons in I_3^+ central atom are 8 while in I_3^- are 10 and hence the geometries are tetrahedral and trigonal bipyramidal.

12.

Ans. (b)

Sol. $B_2 = \sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p_x}^1 \pi_{2p_y}^1$

$$\text{B.O.} = \frac{6-4}{2} = 1$$

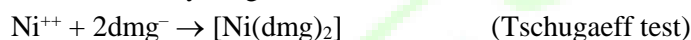
If an electron is added to B_2 , then will go bonding to π -orbital.

$$\text{B.O. becomes} = \frac{7-4}{2} = \frac{3}{2} = 1.5$$

13.

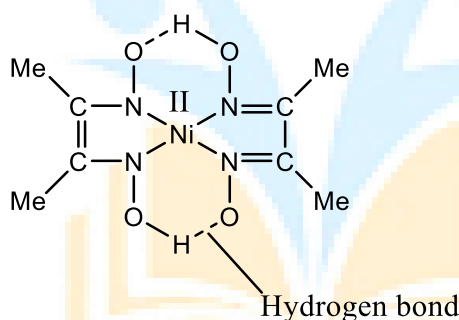
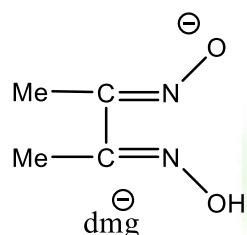
Ans. (a)

Sol. Ni^{++} is tested by dmg.



(Red)

The structure of complex is



There fore,

Ni-N bonds $\rightarrow 4$

Ni-O \rightarrow Zero

Hydrogen bonds \rightarrow two

14.

Ans. (a)

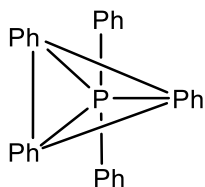
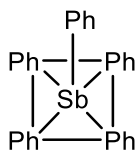
Sol. In $[AgL_4]^{2+}$ and $[AgL_6]^{2+}$, Ag^{2+} has d^9 configuration, hence have unpaired electron. Hence paramagnetic.

$[AgL_4]^{3+} \Rightarrow Ag^{3+}$ has d^8 configuration and dsp^2 hybridization (square planar so pairing of electron)

15.

Ans. (b)

Sol. $SbPh_5$ is square pyramidal while PPh_5 is trigonal bipyramidal.



This is due to size of central atom. 'Sb' is bigger than 'P', therefore favour square planar while small sized 'P' favour trigonal bipyramidal.

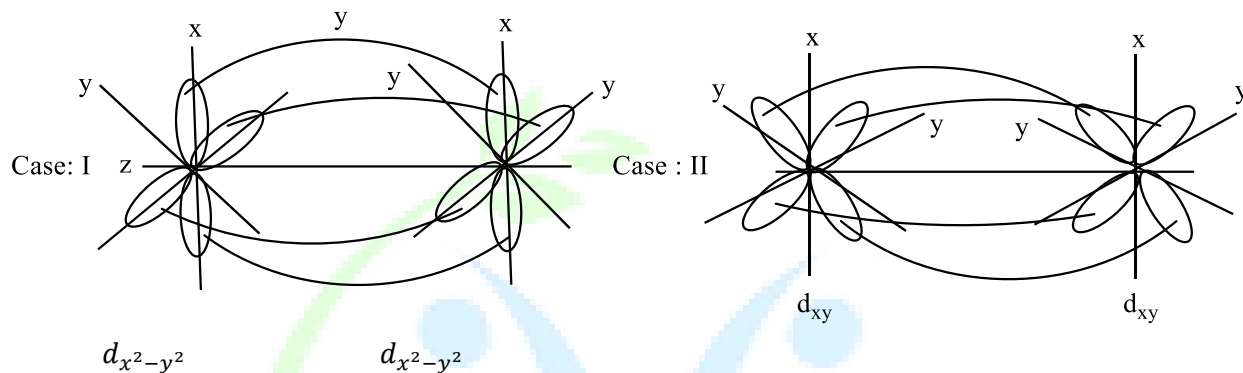


16.

Ans. (a) and (c)**Sol.** A δ -bond involves the overlapping of eight lobes by facewise overlapping. This can take place by 'd'-orbitals and 'f' orbitals.

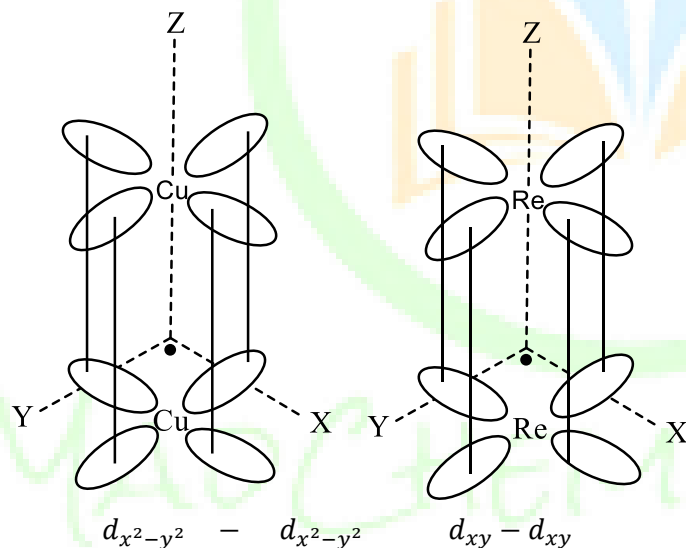
In 'd' orbitals and 'f' orbitals.

In 'd' orbitals following two possibilities are

Case-I: $d_{x^2-y^2} + d_{x^2-y^2} \rightarrow \delta$ -bondCase - II: $d_{xy} + d_{xy} \rightarrow \delta$ -bond.

Both cases are reported in many example like.

Case-I is reported in dimeric copper acetate (II)

Case-II is reported in $\text{Re}_2\text{Cl}_8^{2-}$ 

Hence, option (a) and (c) are correct.

17.

Ans. (a)**Sol.** In the formation of SF_6 the following atomic orbitals are involved.

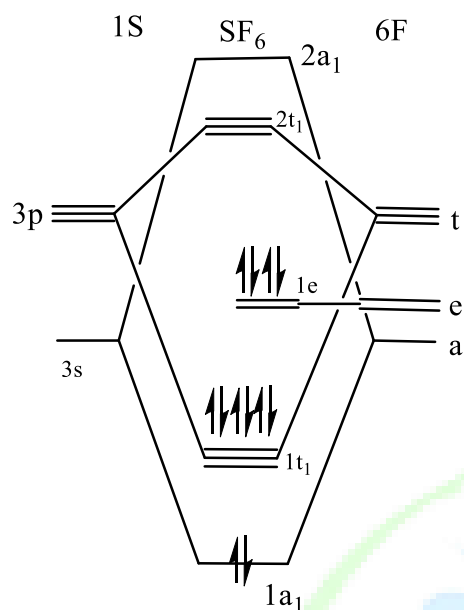
$$S = \frac{1}{3s} \quad \frac{1}{3s} \quad \frac{1}{3s} \quad \frac{1}{3s} \quad 6F = \frac{1}{2p} \quad \frac{1}{2p} \quad \frac{1}{2p}$$

The 3s, 3p of 's' and 2p_z of 'F' are mixed to give ten MO's. Calculations indicate that four of orbitals will be bonding and four of orbitals will be bonding and four will be antibonding. The remaining two will be non-bonding.

There are 12 electrons to be filled in ten MO's. The first two can enter 1a and the next six can in it. The remaining four fill the non-bonding pair of orbitals. Thus it gives $1a^2 1t^6 e^4$ as configuration.



This gives the molecular diagram of SF₆ as



Therefore answer will be

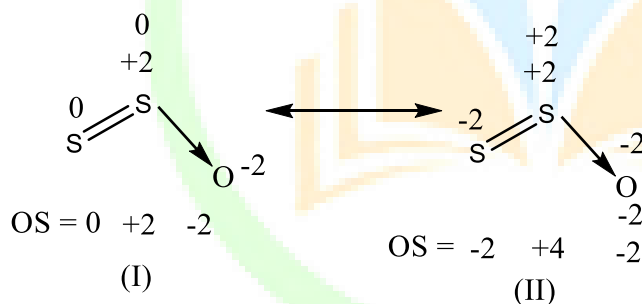
18.

Ans.

(a)

Sol.

The structure of S₂O show resonance as



Hence, the probable O.S. of 'S' are (0 and +2) from structure 'I' and (-2 and +4) from structure II.

19.

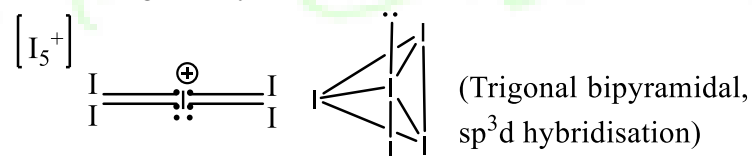
Ans.

(b)

Sol.



Therefore, geometry = tetrahedral



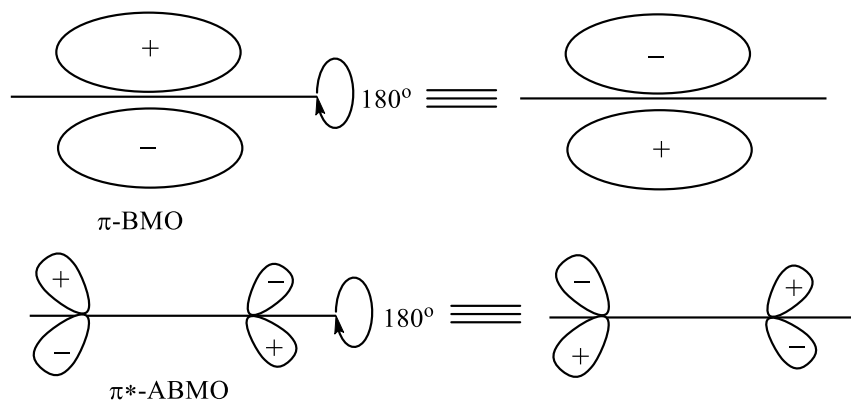
20.

Ans.

(b)

Sol.





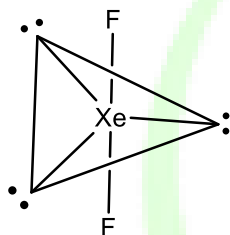
If the sign is changed it is called ' π ' otherwise ' σ '.

21.

Ans. (c)

Sol. XeF_2 ; $S = \text{stearic number} = \frac{8+2}{2} = 5$

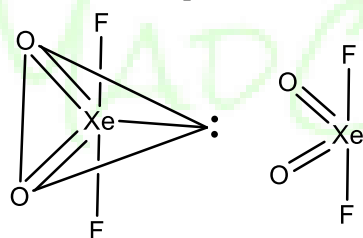
Therefore, $G = \text{Geometry} = \text{trigonal bipyramidal (TBP)}$



Hence, the shape = linear Xe

$\text{XeO}=\text{F}_2$ $s = \frac{8+2}{2} = 5$ Geometry = TBP

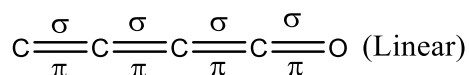
Hence, the shape = see - saw



22.

Ans. (a)

Sol. The structure of C_3O_2 (carbon suboxide) is



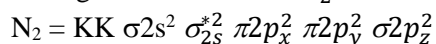
4σ and 4π

23.

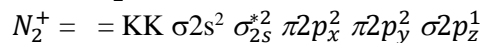
Ans. (c)



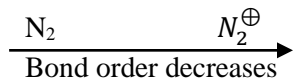
Sol. The MO configuration of N_2 and N_2^+ are



$$B.O. = \frac{8-2}{2} = 3$$



$$B.O. = \frac{7-2}{2} = 2.5$$



24.

Ans. (c)

Sol.

Species	Stearic number	b.p.	l.p
BrF_4^-	$\frac{7 + 4 + 1}{2} = 6$	4	2
XeF_6	$\frac{8 + 6}{2} = 7$	6	1
$SbCl_6^{3-}$	$\frac{5 + 6 + 3}{2} = 7$	6	1

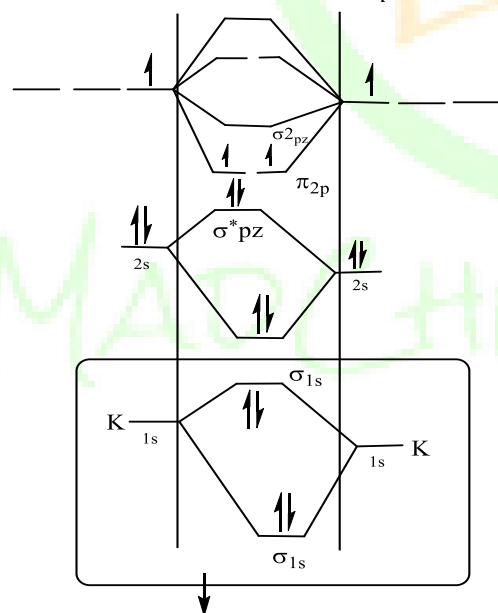
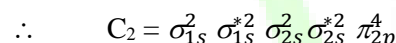
Hence, correct option is (c)

Note : The lone pair of $SbCl_6^{3-}$ is stereochemically inactive and that of XeF_6 is borderline of stereochemically active and stereochemically inactive condition.

25.

Ans. (d)

Sol. $C_2 =$ valence electron = 12



However, σ_{1s}^* is not included in valence shell.

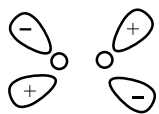
26.

Ans. (b)

Sol. $B_2 = \sigma_{1s}^2 < \sigma_{1s}^{*2} < \sigma_{2s}^2 < \sigma_{2s}^{*2} < \pi_{2p_x}^1 = \pi_{2p_y}^1 < \sigma_{2p_z} < \pi_{2p_x}^* = \pi_{2p_y}^* < \sigma_{2p_z}^*$
 $\pi^* =$ gerade while $\pi =$ ungerade

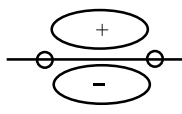


π^* = gerade while π = ungerade



π^*
(gerade)

Centre of symmetry



(u)
(ungerade)

No centre of symmetry

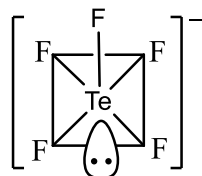
27.

Ans. (b)

Sol. $[\text{TeF}_5]^- = \frac{6+5+1}{2} = 6 \text{ sp}^3\text{d}^2$

Number of lone pair = 1

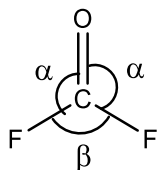
Structure is square pyramidal



28.

Ans. (c)

Sol. Structure of $\text{COF}_2 =$

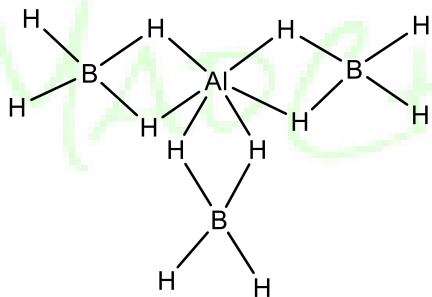


due to more space requirement for double bond the bond angle F-C-O will be higher than that of F-C-F and also C-O bond order is larger than C-F hence, C-O bond length will be smaller than C-F .

29.

Ans. (c)

Sol. The structure of $[\text{Al}(\text{BH}_4)_3]$ is



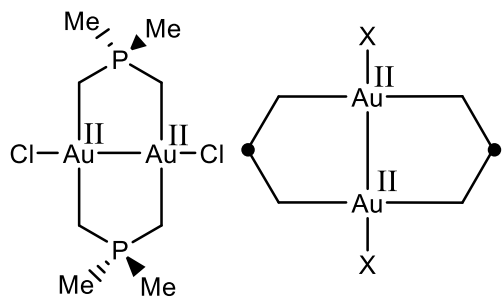
Thus, number of $3c-2e^-$ bond is equal = 6

30.

Ans. (c)

Sol. Oxidation state of gold in this complex is 2





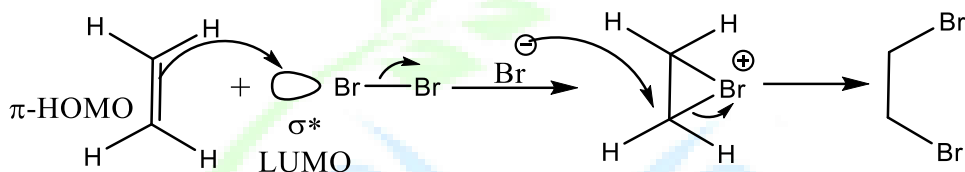
Au^{II} in +2 oxidating state

31.

Ans.

(a)

Sol.

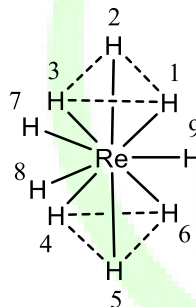


32.

Ans.

(a) & (c)

Sol. $[\text{ReH}_9]^{2-} \rightarrow$ Tricapped trigonal prismatic



Atoms 1 to 6 are the prism atoms, 7 to 9 are H-atom are equatorial hydrogen.

33.

Ans.

(c)

Sol. $[\text{Rh}_6\text{C}(\text{CO})_{15}]^{2-}$

$$\text{TVE} = 9 \times 6 + 4 + 15 \times 2 + 2 = 54 + 4 + 2 + 30 = 90$$

Hence, it has trigonal prism geometry.

34.

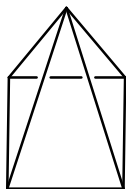
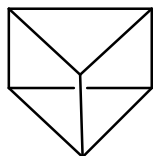
Ans.

(a)

Sol. Number of triangular anti-prism are 8, in icosahedron it is 20 and in tricapped trigonal prism capped on square faces) it is 14



On capping to square faces



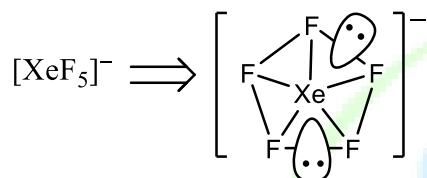
4 new faces are generated and
4 triangular faces. Hence,
total faces become $4 \times 3 + 2 = 14$

35.

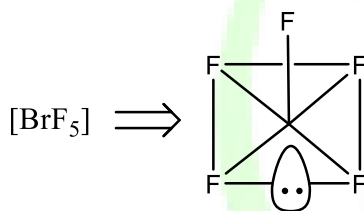
Ans.

(a)

Sol.



Shape = Pentagonal planar



Shape = square pyramidal

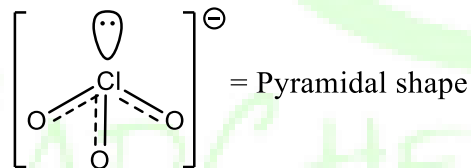
36.

Ans.

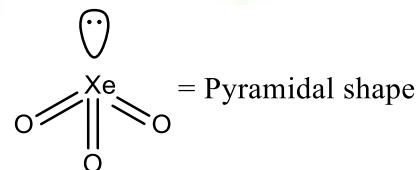
(a)

Sol.

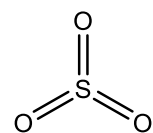
$$\text{ClO}_3^- \Rightarrow \frac{7+6 \times 3+1}{8} = \frac{26}{8} = 3 + 1 = 4 \rightarrow sp^3 \text{ [Tetrahedral]}$$



$$\text{XeO}_3 = \frac{8+6 \times 3}{8} = \frac{26}{8} = 3 + 1 = 4 \rightarrow sp^3 \text{ (Tetrahedral)}$$



$$\text{SO}_3 \Rightarrow \frac{6+6 \times 3}{8} = \frac{24}{8} = 3 \rightarrow sp^2 \text{ (Trigonal planar)}$$



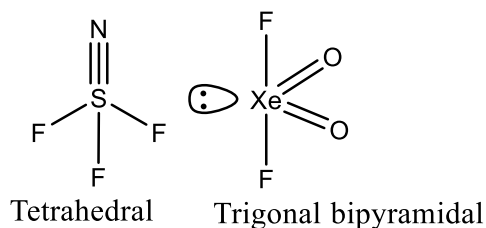
37.

Ans.

(d)



Sol. $\text{SNF}_3 = \frac{6+5+7 \times 3}{8} = \frac{32}{8} = 4 = \text{sp}^3 = \text{Td}$
 $\text{XeO}_2\text{F}_2 \Rightarrow \frac{8+6 \times 2+7 \times 2}{8} = \frac{34}{8} = 4 + 1 = 5 = \text{sp}^3\text{d} \Rightarrow \text{TBP}$



38.

Ans. (b)

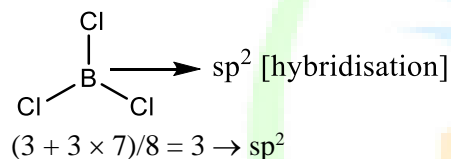
Sol. According to electroneutrality principle, each atom in any stable substance has a charge close to zero. This means if central atom has more positive charge then it would be stabilized by ligand having high negative charge density i.e. more electronegative donor atom.

In case of $[\text{Al}(\text{NH}_3)_6]^{3+}$, nitrogen is sp^3 hybridized hence it is least electronegative hence least stable complex.

39.

Ans. (b)

Sol.



40.

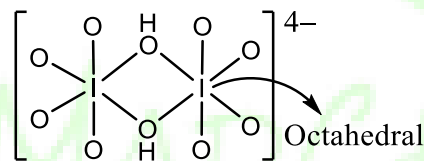
Ans. (a)

Sol. According to Bent's Rule, 'more electro negative element occupy axial position in trigonal bipyramidal geometry.'

41.

Ans. (a)

Sol.



42.

Ans. (b)

Sol. According to MOT

$$\text{NO} \rightarrow \sigma_{1s}^2 < \sigma_{1s}^{*2} < \sigma_{2s}^2 < \sigma_{2s}^{*2} < \pi_{2p_1}^2 = \pi_{2p_1}^2 < \sigma_{2p_1}^2 < \pi_{2p_1}^{*1} = \pi_{2p_1}^* < \pi_{2p_1}^*$$

$$\text{Bond order of NO} = \frac{10-5}{2} = 2.5$$

$$\text{Bond order of NO}^- \rightarrow \frac{10-4}{2} = 3$$

Hence, as bond order increases $\nu(\text{NO}^*)$ increases and $\text{NO}^- \rightarrow \text{EPR inactive}$

In NO^- HOMO is σ_{2p_z} that is close to more electronegative atom (Oxygen).

43.

Ans. (c)



Sol. The energy difference between π^* and σ^* of I_2 is very small and it absorbs at $\lambda_{\max} = 520$ nm. When I_2 is dissolved in a non-donor solvent, there is no effect on energies of π^* and σ^* of I_2 and it absorbs at $\lambda_{\max} = 520$ nm. Interaction of solvent donor orbital with the σ^* , I_2 LUMO result in a lower occupied bonding orbital and a higher unoccupied bonding orbital. As a result the $\pi^* \rightarrow \sigma^*$ transition for the $I_2 + \text{donor}$ adduct is shifted higher in energy and lower wavelength.

Hence, π -electron donor < weak donor < strong donor

44.

Ans. (b)

Sol. On descending the group, the stability of +3 oxidation state increases and that of +5 oxidation state decreases. Size usually increases on descending the group ($P = 1.10 \text{ \AA}$ and $As = 1.21 \text{ \AA}$). Thus, $AsCl_5$ is thermally less stable than PCl_5 and As is larger than P but less stability of $AsCl_5$ is not due to larger size of As, instead it is due to inert pair effect.

45.

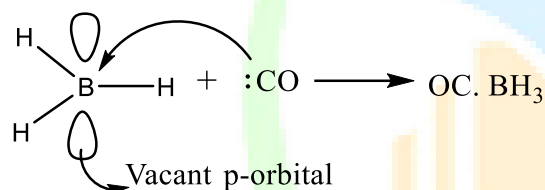
Ans. (b)

Sol. NO , I_2^- , Cu^{2+} and VO^{2+} is paramagnetic, Hence, EPR active whereas I_2 is diamagnetic and EPR inactive.

46.

Ans. (b)

Sol.

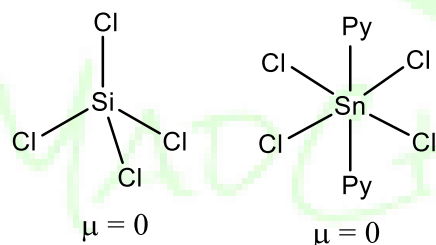


In BH_3 , CO formation CO interact with vacant p-orbital, whereas electron is donated by antibonding orbital of CO due to which bond order increases and ν_{CO} increases.

47.

Ans. (c)

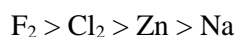
Sol.



48.

Ans. (b)

Sol. The standard reduction potential in acid follows the order.



49.

Ans. (c)

Sol. According to MOT the LUMO of CN^- and O_2 respectively are π_g and σ_u .

50.

Ans. (a)

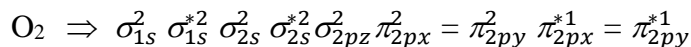
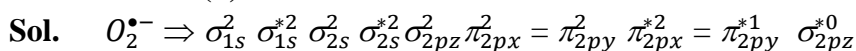


Sol. As bond order increases, stretching frequency increases.

$$O_2^+ = 2.5, O_2 = 2, O_2^- = 1.5, O_2^{2-} = 1$$

51.

Ans. (b)



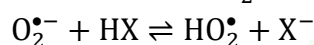
$$(\text{B.O.})_{O_2^{\bullet-}} = \frac{6-3}{2} = 1.5$$

$$(\text{B.O.})_{O_2} = \frac{6-2}{2} = 2$$

$$\text{Bond order} \propto \frac{1}{\text{Bond length}}$$

Bond order of O_2 is more than $O_2^{\bullet-}$ thus, bond length of $O_2^{\bullet-}$ is more than O_2 .

• The superoxide ion $O_2^{\bullet-}$ is able to abstract proton from weak acids. It reacts with a proton or proton donor to form HO_2^{\bullet} .



• The superoxide ion $O_2^{\bullet-}$ is a stronger oxidising agent than O_2 .

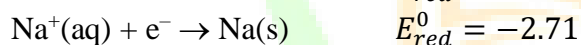
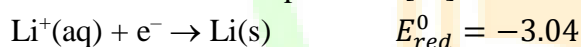
• $O_2^{\bullet-}$ does not possess dipole moment thus, it is IR inactive.

52.

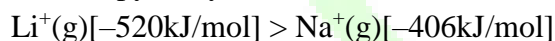
Ans. (c)

Sol. • LiF is sparingly soluble in water but for large anions such as ClO_4^- , the Li^+ salts are soluble in water.

• Standard reduction potential [E^0] of Li is more negative than that of Na.



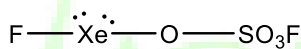
• Enthalpy of hydration :



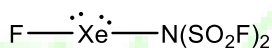
53.

Ans. (a)

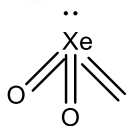
Sol.



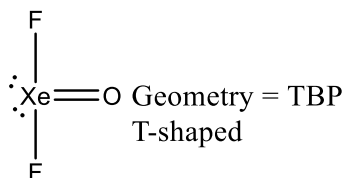
Geometry = TBP
Linear shape



Geometry = TBP
Linear shape



Geometry = Tetrahedral
Pyramidal shape

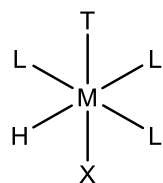


54.

Ans. (b)

Sol. Dissociation substitution for octahedral complex





(A) High steric hindrance between ligand courses repulsion and favours dissociation.

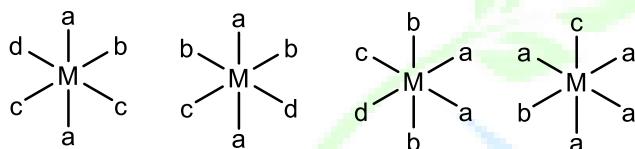
(C) PentaCoordinated intermediate is observed as complex loses one ligand.

a and c is correct

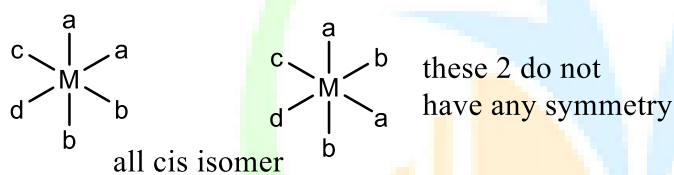
55.

Ans. (b)

Sol. Ma_2b_2cd



all 4 have one plane

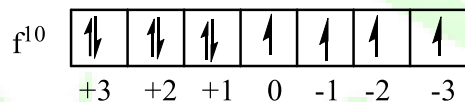


So the form enantiomeric pair

56.

Ans. (a)

Sol.



$$S = 2 \times 4 = 2$$

$$L = 3 + 2 + 1 = 6$$

$$J = |L+S| \text{ for more than half filled}$$

$$= 8$$

$$g = 1 + \frac{S(S+1) - L(L+1) + J(J+1)}{2J(J+1)}$$

Dutting value

$$g = 1.25$$

$$U_{\text{eff}} = g\sqrt{J(J+1)}$$



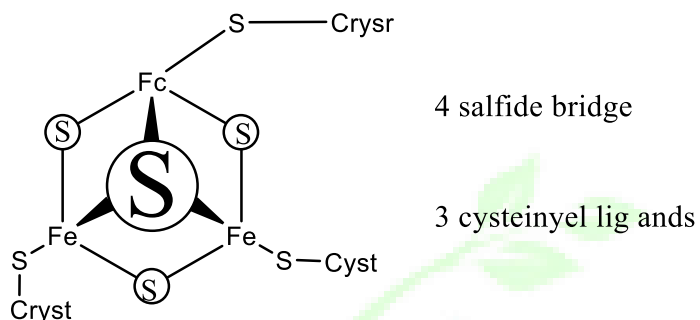
$$= 1.25 \sqrt{8(8+1)}$$

$$= 10.6$$

57.

Ans. (c)

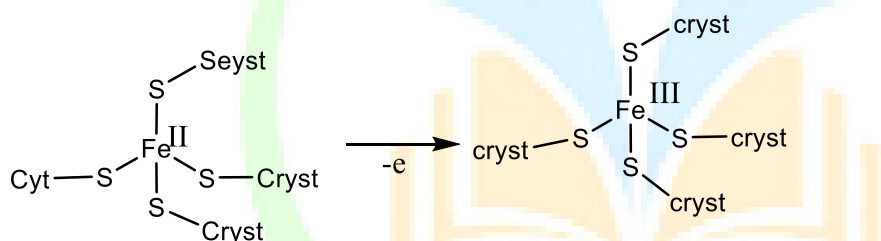
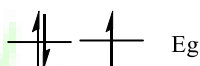
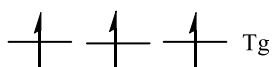
Sol.



58.

Ans. (d)

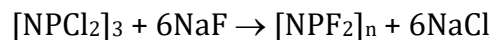
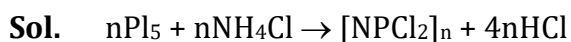
Sol. Rubredoxin

high spin $d^6 \rightarrow$ So paramagnetic.

Undergoes Jahn-Teller distortion

59.

Ans. (d)



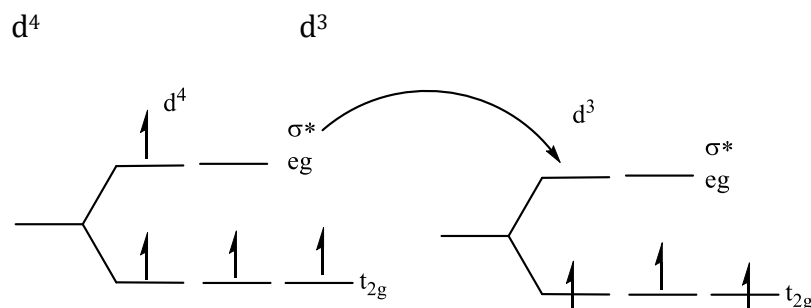
So, (i) and (ii) recur

Correct (4) (iii) C only (not possible)

60.

Ans. (a) and (b)

Sol. $[\text{Cr}(\text{H}_2\text{O})_6]^{2+/3+}$ self electron mechanism Cr^{+2} Cr^{+3} 



σ^* orbitals are involved

It involves large inner sphere reorganization energy as bond length changes $\sigma^* \rightarrow \sigma^*$ slow transfer.

Correct option (ii) a and b

61.

Ans. (c)

Sol. D.C polarography

Polarography heads supporting electrolyte Gelatin is also added

Depolarization of electrode (Mercury drop)

Takes place.

62.

Ans. (b)

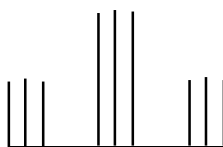
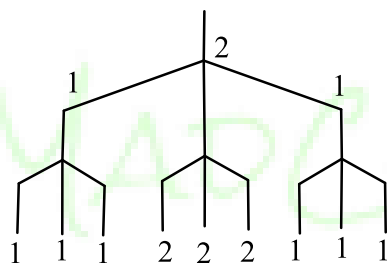
Sol. $\text{TiCl}_3 (\text{CDH}_2)$

$$^1J_{\text{C-H}} > ^1J_{\text{C-D}}$$

$$(2nI+1) \quad \text{For C-H}$$

$$2 \times 2 \times \frac{1}{2} + 1 = 3 \quad \text{For C-D}$$

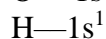
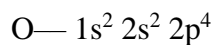
$$2 \times 1 \times 1 + 1 = 3$$

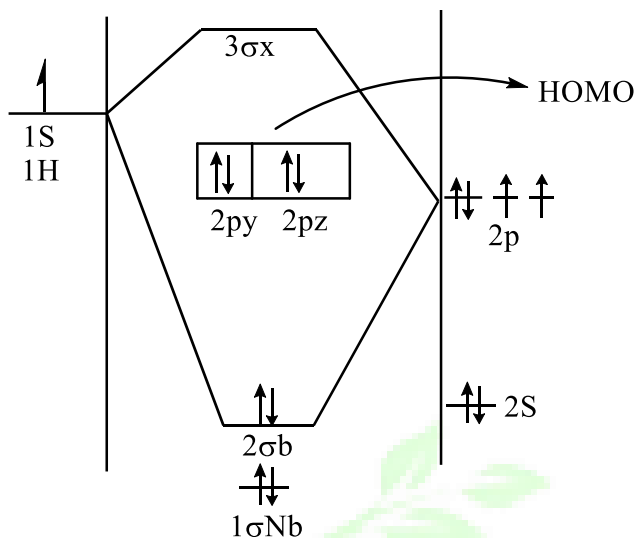


63.

Ans. (b)

Sol. OH^-





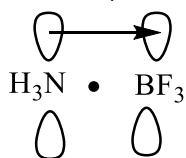
64.

Ans.

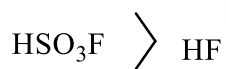
(d)

Sol.

Metal oxide is basic – FeO

NH₄Cl is more acidic than FeO.

less acidic



Superacids

(More acidic)

65.

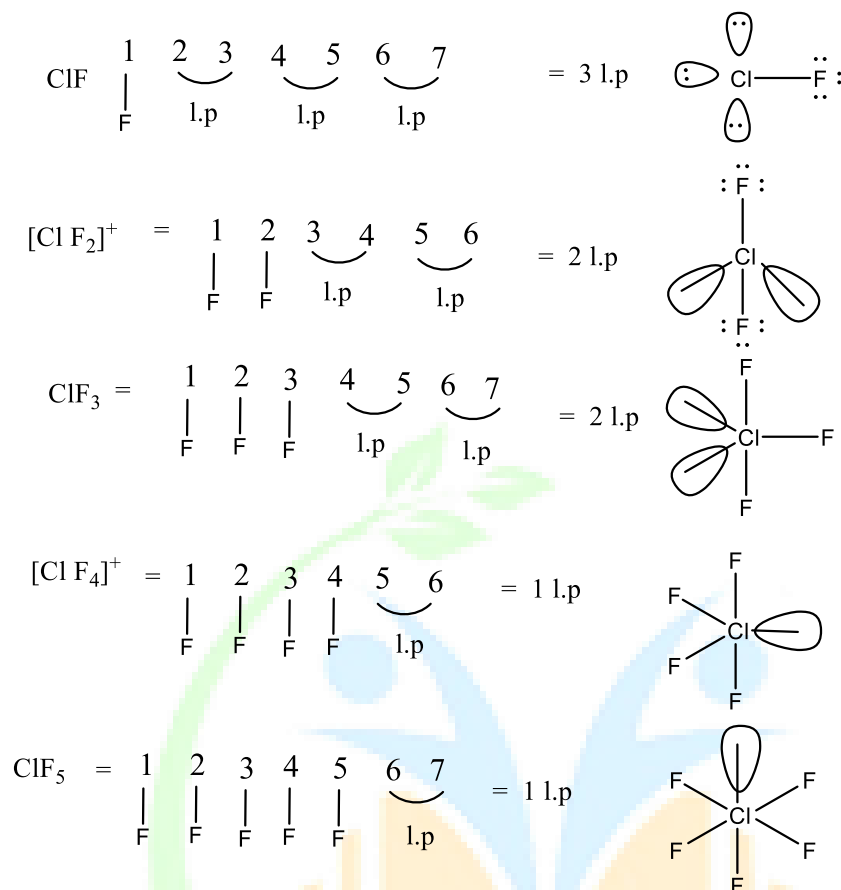
Ans.

(b)

Sol.

MADCHEM CLASSES





66.

Ans.

(d)

Sol.

Bond order – Li_2 C_2 B_2 N_2

 1 2 1 3

$\text{N}_2 > \text{C}_2 > \text{B}_2 \sim \text{Li}_2$

$\Rightarrow \text{SbH}_3$ has lowest melting point

\Rightarrow Electronegativity of $\text{S} > \text{P}$.

Ionization energy –

$3\text{Li} - 1s^2, 2s^1 \rightarrow 1s^2$

$5\text{B} - 1s^2, 2s^2, 2p^1 \rightarrow 1s^2, 2s^2$

$4\text{Be} - 1s^2, 2s^2 \rightarrow 1s^2, 2s^1$

$6\text{C} - 1s^2, 2s^2, 2p^2 \rightarrow 1s^2, 2s^2, 2p^1$

across the period I.P increases.

$\text{C} > \text{Be} > \text{B} > \text{Li}$

$\text{P}^2 > \text{S}^2 > \text{P}^1 > \text{S}^1$

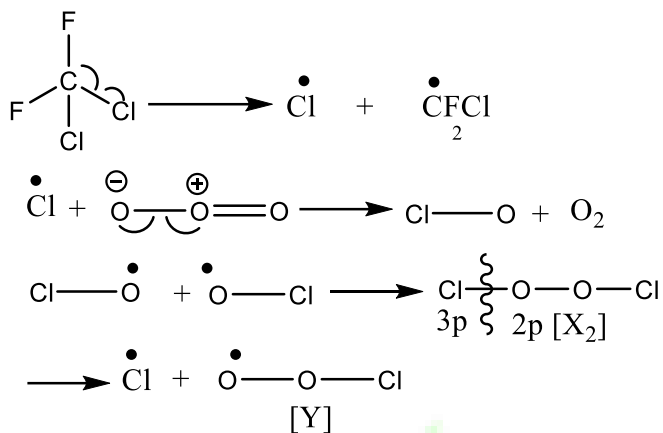
67.

Ans.

(b)

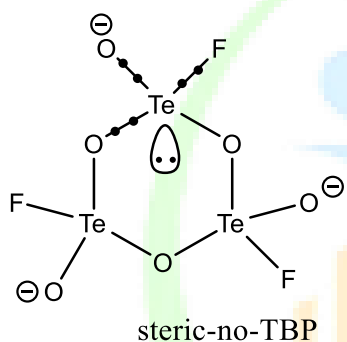
Sol.





68.
Ans.
Sol.

(c)
[TeO₂F]⁻



It Exist
in Terimeric form
not Td.

69.
Ans.
Sol.

(c)

