Preface

The idea of the book entitled **"Inorganic Chemistry: SET PYQ's"** was born because of the lack of any comprehensive book covering all the aspects of various entry level chemistry competitive examinations in particular conducted by CSIR, GATE, TIFR State and National Eligibility Test, but not limited to.

This book covers all PYQ's with topic wise sorted question and solution

1. Chemical Periodicity
2. Chemical Bonding
3. Main Group Element
4. Coordination Chemistry
5. Inner Transition Element
6. Organometallic Chemistry
7. Bioinorganic Chemistry
8. EPR Spectroscopy
9. Nuclear Chemistry
10. Chemistry of Acid and Base
11. Analytical Chemistry
12. General Chemistry.

The ultimate purpose of this book is to equip the reader with brainstorming challenges and solution for inorganic chemistry and applied aspect examinations. It contains predigested information on the entire academic subject of inorganic chemistry for good understanding, assimilation, self-evaluation, and reproducibility. Although we have made every effort to make the book error free, we are under no illusion. We welcome comments, criticism and suggestions from the readers to evolve the contents.

Acknowledgement

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And finally, our humble greetings to all who put their significant efforts and are unmentioned.

INDEX

CHAPTER NO.	CHAPTER NAME	PAGE NO.
1	CHEMICAL PERIODICITY	1
2	CHEMICAL BONDING	18
3	MAIN GROUP ELEMENTS	50
4	COORDINATION CHEMISTRY	75
5	INNER TRANSITION ELEMENTS	137
6	ORGANOMETALLIC CHEMISTRY	150
7	BIOINORGANIC CHEMISTRY	183
8	EPR SPECTROSCOPY	205
9	NUCLEAR CHEMISTRY	218
10	CHEMISTRY OF ACID AND BASES	222
11	ANALYTICAL CHEMISTRY	234
12	GENERAL CHEMISTRY	247

CHEMICAL PERIODICITY

CHAPTER 1

MH SET

(MH-SET 25 Nov. 2011)

1. The number of nodes in a 3s orbital is:
   (A) 0 (B) 1
   (C) 2 (D) 3

(MH-SET 25 Nov. 2011)

2. The three unpaired electrons on the nitrogen atom is ascribed to :
   (A) Pauli's exclusion principle
   (B) Aufbau principle
   (C) Hund's rule
   (D) Uncertainty principle

(MH-SET 25 Nov. 2011)

3. Which of the following specie have distorted octahedral structures?
   (A) SF_6 (B) $[PF_6]^-$
   (C) SbF_5 (D) XeF_6

(MH-SET 25 Nov. 2011)

4. Which one of the following compounds readily forms dimers?
   (A) $AsCl_3$ (B) $AlCl_3$
   (C) PCl_3 (D) BCl_3

(MH-SET 2015)

5. The strength of hydrogen bonds follow the order:
   (A) ClH .... Cl > NH .... N > OH .... O > FH .... F
   (B) ClH .... Cl < NH .... N < OH .... O < FH .... F
   (C) ClH .... Cl < NH .... N > OH .... O > FH .... F
   (D) ClH .... Cl < NH .... N < OH .... O > FH .... F

(MH-SET 2015)

6. First and second ionization energies of Mg are 7.646 and 15.035 eV respectively. The amount of energy in kJ needed to convert all the atoms of magnesium into Mg^{2+} ions present in 12 mg of magnesium vapors is:
   (A) 1.5 (B) 2.0
   (C) 1.1 (D) 0.5

(MH-SET 2015)

7. Which of the following is the correct order of 1^{st} Ionization Potential:
   (A) Ca > Sr > Ba > Mg (B) Ba > Mg > Ca > Sr
   (C) Sr > Ca > Mg > Ba (D) Mg > Ca > Sr > Ba

(MH-SET 2015)

8. The correct order of the basicity of the following oxides:
   (A) $NO_2<CO_2<Na_2O<Al_2O_3$ (B) $CO_2<NO_2<Al_2O_3<Na_2O$
   (C) $NO_2<CO_2<Al_2O_3<Na_2O$ (D)$Al_2O_3<Na_2O<NO_2<CO_2$

(MH-SET 2018)

9. The correct order of First Ionization energy of group 13 elements is:
   (A) B > Tl > Ga > Al > In (B) B > Tl > Al > Ga > In
   (C) B > Al > Ga > In > Tl (D) B > Ga > Tl > In > Al

(MH-SET 2018)

10. The ionophore valinomycin is highly selective for:
    (A) K^+ (B) Na^+
    (C) Mg^{2+} (D) Ca^{2+}

(MH –SET 2019)

11. Size of the d orbitals for Si, P, S and Cl follow the order:
    (A) Si > P > S > Cl (B) Cl > P > S > Si
    (C) Cl > S > P > Si (D) P > S > Si > Cl

(MH – SET 2020)

12. The hydrogen bond strength in
    (i) O—H.....O
    (ii) O—H.....Cl
    (iii) O—H.....N will follow the order:
    (A) (i) > (iii) > (ii) (B) (ii) > (i) > (iii)
    (C) (i) = (ii) > (iii) (D) (i) > (ii) > (iii)

(MH – SET 2020)

13. The strength of hardness of the isoelectronic ions F^-, ^-OH, $^-NH_2$ and $^-CH_3$ follows the order:
    (A) $^-CH_3>^-OH>^-NH_2>F^-$ (B) $^-CH_3>F^->^-OH>^-NH_2$
    (C) $F^->^-OH>^-NH_2>^-CH_3$ (D) $^-CH_3>^-NH_2>^-OH>F^-$

GUJARAT SET

[GUJARAT SET 2014]

14. Which SET of quantum numbers is possible for an element?
    (A) n = 1, l = 1, m = 0, s = -1/2
    (B) n = 2, l = 1, m = 0, s = +1/2
    (C) n = 2, l = 0, m = -2, s = +1/2
    (D) n = 1, l = 0, m = 1, s = -1/2

(GJ-SET 2014)

15. The strongest van der Waals interaction is present in:
(A) F_2 (B) Cl_2
(C) Br_2 (D) I_2

(GJ-SET 2014)

16. Greater the number of lone pairs on a central atom, the contraction caused in the bond angle will be:
(A) Less (B) More
(C) no effect (D) Balance the angle

(GJ-SET 2014)

17. Comparing structure and properties of:
(I) $Na^+(CH_2C_6H_5)^-$ and (II) $Na^+(C_6H_5)^-$
Which of the following statements is not correct?
(A) Both (I) and (II) belongs to the class of ionic organometallic compounds
(B) The nucleophilic character of (I) is less than (II)
(C) (I) is stabilized by resonance while (II) is not
(D) Reactivity of (I) > (II)

(GJ-SET 2014)

18. The correct order of second ionization potential of C, N, O and F is:
(A) C > N > O > F (B) O > N > F > C
(C) O > F > N > C (D) F > O > N > C

(GJ-SET 2014)

19. Fluorine has the highest electronegativity amongst ns^2np^5 group but electron affinity of F is less than that of Cl because:
(A) The atomic number of F is less than that of Cl
(B) F behaves in unusual manner
(C) Cl can accommodate an electron better than F by utilizing its vacant 3d orbital
(D) High electron density makes an addition of an electron less favorable than Cl.

(GJ-SET 2014)

20. Most substances expand when heated in all temperature ranges. Water exhibits anomalous behavior. It contracts when heated between 0^0 and 4^0C. Which of the following statements is the appropriate to this behavior?
(A) Ice has an open cage like structure
(B) In ice, water molecules are both covalently as well as hydrogen bonded
(C) When ice melts, density increases as water molecules come closer together to filling up empty spaces in the cage structure
(D) In ice, water molecules are tetrahedrally oriented with respect to each other.

(GJ-SET 2017)

21. Which of the following species has the largest dissociation energy?
(A) CN (B) BN
(C) CN^- (D) NO

(GJ-SET 2018)

22. The van der Waals radii of O, N, Cl, F and Ne increase in the order:
(A) F, O, N, Ne, Cl (B) N, O, F, Ne, Cl
(C) Ne, F, O, N, Cl (D) F, Cl, O, N, Ne

(GJ-SET 2019)

23. The radial part of an atomic orbital wave function depends upon:
(A) l only (B) n only
(C) n, l and m (D) m only

(GJ-SET 2019)

24. The values of electronegativity of atoms M and N are 2.5 and 1.05, respectively. The % ionic character of M-N bond is:
(A) 28.80% (B) 34.20%
(C) 38.50% (D) 45%

HP SET

[HPSET 2014]

25. In which of the following pairs do the two species resemble each other most closely in chemical properties?
(A) $\frac{1}{1}H$ and $\frac{1}{1}H^+$ (B) $\frac{14}{7}N$ and $\frac{14}{7}N^{3-}$
(C) $\frac{12}{6}C$ and $\frac{13}{6}C$ (D) All of the above

(HP –SET 2019)

26. An atomic orbital has two angular nodes and one radial node. It is a:
(A) 2p orbital (B) 3p orbital
(C) 3d orbital (D) 4d orbital

KARNATAKA SET

(KA-SET 2020)

27. The filling of molecular orbitals takes place according to:
(A) The Aufbau principle
(B) Pauli Exclusion principle
(C) Hund's rule of maximum multiplicity
(D) All of the mentioned above

AP SET

(AP-SET 2012)

28. The correct increasing order of second ionization energy of elements X, Y, Z with respective atomic numbers 19, 20, 38 is
(A) X, Y, Z (B) X, Z, Y
(C) Z, Y, X (D) Z, X, Y

(AP-SET 2014)

29. The correct decreasing order of the first ionization energy of the elements P, S, Cl is:
(A) Cl, S, P (B) Cl, P, S
(C) P, Cl, S (D) S, Cl, P

(AP-SET 2014)

30. The number of radial nodes for a 3s orbital is:
(A) 0 (B) 1
(C) 2 (D) 3

(AP-SET 2014)

31. Which of the following has the highest Pauling's electronegativity value?
(A) Be (B) Mg
(C) Ca (D) Ba

(AP-SET 2014)

32. Match the following

List – I	List – II
I. Orbital angular momentum quantum number	1. M_l
II. Magnetic quantum number	2. l
III. Spin quantum number	3. J
IV. Total angular momentum quantum number	4. S

	1	2	3	4
(A)	I	II	III	IV
(B)	I	III	II	IV
(C)	II	I	IV	III
(D)	III	IV	I	II

(AP-SET 2014)

33. Among the halogens from Cl to I, decreasing trend is observed with respect to:
I. Ionization energy
II. Electro positivity
III. Electronegativity
IV. Metallic characterthe correct combination is
(A) I, II (B) I, III
(C) II, III (D) II, IV

(AP-SET 2018)

34. A 3d atomic orbital has:
(A) one radical node and one angular node
(B) Two angular nodes
(C) Two radical nodes
(D) No nodes

JAMMU KASHMIR SET

(J & K-SET 2011)

35. The second ionization energies of Li, Be, B and C are in the order:
(A) Li > C > B > Be (B) Li > B > C > Be
(C) B > C > Be > Li (D) Be > C > B > Li

(J & K-SET 2011)

36. All Cu (II) halides are known except the iodide. The reason for is that:
(A) iodide is a bulky ion
(B) Cu^{2+} oxidizes iodide to iodine
(C) Cu^{2+} (aq) has much more negative hydration enthalpy
(D) Cu^{2+} ion has smaller size

(J&K SET 2011)

37. Maximum number of electrons in a shell with principal quantum number 'n' is given by:
(A) n (B) 2n
(C) n^2 (D) $2n^2$

(J&K SET 2012)

38. The correct order of electron gain enthalpy with negative sign of F, Cl, Br, and I having atomic number 9, 17, 35, and 53 respectively is:
(A) F < Cl < Br < I (B) Cl < F < Br < I
(C) I < Br < F < Cl (D) Cl < Br < I < F

(J&K SET 2012)

39. Properties of elements are periodic function of number of _____ present in the nucleus:
(A) Protons (B) Electrons
(C) Neutrons (D) Mesons

(J&K SET 2012)

40. Which of the following elements has the highest value of electron affinity?
(A) O (B) S
(C) Se (D) Te

(J & K-SET 2016)

41. Electronegativities of atoms changes _____rapidly when crossing d block than while crossing the p block elements.
(A) less (B) more
(C) very less (D) huge

(J & K-SET 2016)

42. Which of the following pair of reagents will not react to form product?
(A) PF_5 + CsF (B) XeF_6 + BF_3
(C) RbBr + $BaBr_2$ (D) NaF + ALF_3

(J & K-SET 2018)

43. The number of radial nodes for a 3s orbital is
(A) 0 (B) 1
(C) 2 (D) 3

(J & K-SET 2018)

44. The correct decreasing order of the first ionization energy of the elements P, S, CI is
(A) CI, S, P (B) CI, P, S
(C) P, CI, S (D) S, CI, P

(J & K - SET 2018)

45. Match the following

List – I	List – II
I. Orbital angular momentum	1. M_l quantum number
II. Magnetic quantum	2. l number
III. Spin quantum	3. j number
IV. Total angular momentum	4. S quantum number

	1	2	3	4
(A)	I	II	III	IV
(B)	I	III	II	IV
(C)	II	I	IV	III
(D)	III	IV	I	II

(J & K-SET 2018)

46. Among the halogens from Cl to I, a decreasing trend is observed with respect to
I. Ionization energy
II. Electropositivity
III. Electronegativity
IV. Metallic character
The correct combination is
(A) I, II (B) I, III
(C) II, III (D) II, IV

(J & K-SET 2018)

47. Assertion (A): The radius of Fe^{3+} is less than that of Fe^{2+}. Reason (R): Fe^{3+} has a lower effective nuclear charge than Fe^{2+}.
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

(J & K-SET 2018)

48. The correct ground state configuration for Chromium is:
(A) [Ar] $3d^4 4s^2$ (B) [Ar] $3d^5 4s^1$
(C) [Ne] $3d^5 4s^1$ (D) [Ne] $3d^4 4s^2$

KA SET

(KA –SET 2014)

49. Which one of the following is incorrect with respect to the property indicated?
(A) Electronegativity: $F_2 > Cl_2 > Br_2$
(B) Electron affinity: $Cl_2 > F_2 > Br_2$
(C) Oxidizing power: $F_2 > Cl_2 > Br_2$
(D) Bond energy: $F_2 > Cl_2 > Br_2$

(KA –SET 2014)

50. Which one of the following SETs indicate the correct variation in electro negativities?
(A) F > N < O > C (B) F > N > O > C
(C) F < N < O < C (D) F < O > N > C

(KA-SET 2015)

51. The reduced ionization energy within a given family of non-transition elements is due to:
(A) increase in size
(B) increase in shielding
(C) combined effect of increased size and shielding
(D) combined effect of increased size and decreased shielding

(KA-SET 2015)

52. Which of the following pair of elements form covalent compounds:
(1) C and S
(2) Na and Cl
(3) S and O
(4) Ca and H
(A) 1 and 2 (B) 1 and 3
(C) 2 and 4 (D) 2 and 3

53. The electronegativity difference is the highest for the pair:
(A) Na, F (B) Li, F
(C) Li, CI (D) K, F

54. The correct order of decreasing electronegativity and ionic size is as follows
(A) $Al > Ca > S > As$; K+ > $Cl-$ > $Ca2+$ > $S2-$
(B) $S > As > Al > Ca; S^{2-} > Cl^{-} > K^{+} > Ca^{2+}$
(C) $S > As > Ca > Al; S^{2-} > Cl^{-} > K^{+} > Ca^{2+}$
(D) $As > Al > Ca > S;\ K^{+} > Ca^{2+} > S^{2-} > Cl^{-}$

(KA-SET 2016)

55. Which of the following pairs has the highest difference in their first ionization energy?
(A) Xe, Cs (B) Ne, Na
(C) Kr, Rb (D) Ar, K

(KA-SET 2017)

56. The atom with the highest ionization potential is:
(A) Boron (B) Carbon
(C) Nitrogen (D) Oxygen

(KA-SET 2017)

57. H_2S gas is passed through an acidic solution containing Pb^{2+}, Zn^{2+}, Cu^{2+} and Ni^{+2} ions. The precipitate will consist of:
(A) ZnS and PbS (B) PbS and NiS
(C) NiS and CuS (D) CuS and PbS

(KA-SET 2017)

58. Which of the following can be acceptable electronic configuration of xenon atom in the first excited state?
(A) $5s^25p^6$ (B) $5s^25p^45d^2$
(C) $5s^25p^55d^1$ (D) $5s^25p^35d^3$

KL SET

(KL-SET 2012)

59. The number of radial nodes for the 3s orbital of hydrogen atom is:
(A) 0 (B) 1
(C) 2 (D) 3

(KL-SET 2013)

60. Which of the following is the salt of an organic acid?
(A) Rochelle salt (B) Microcosmic salt
(C) Mohr's salt (D) Zeise's salt

(KL -SET 2013)

61. The electronic configuration of the element X is [Ar] $4S^2d^{10}$. Which one of the following is the most suitable formula for its oxide?
(A) X_2O (B) X_2O_3
(C) XO (D) X_2O_5

(KL -SET 2013)

62. Atomic nuclei having same neutron number, N and hence different Z and A values are called:
(A) Isobars (B) Isotones
(C) Isotopes (D) Isomers

63. Which of the following is not a greenhouse gas?
(A) O_3 (B) CH_4
(C) N_2 (D) CO_2

(KL-SET JUNE 2015)

64. Which one of the following indicates the correct order of variation in atomic size?
(A) B > Be > C > N (B) Be > C > N > B
(C) Be > B > C > N (D) N > C > B > Be

(KL-SET JUNE 2015)

65. Which of the following elements is metalloid?
(A) C (B) P
(C) Pb (D) As

(KL-SET JUNE 2015)

66. The second ionization energy of C, N, O and F is of the order
(A) C < N < O < F (B) C < N < F < O
(C) O < N < C < F (D) C < F < O < N

(KL-SET JUNE 2015)

67. The binding energy per nucleon of ^{16}O and ^{17}O are 7.98 MeV and 7.76 MeV respectively then the energy required in MeV to remove a neutron from ^{17}O is
(A) 3.58 (B) 7.76
(C) 4.24 (D) 7.98

(KL-SET JUNE 2015)

68. Total number of nodes (planar and spherical) present in the 5f-orbital is:
(A) One (B) Two
(C) Three (D) Four

(KL-SET JUNE 2015)

69. The effective nuclear charge at the periphery of nitrogen atom when an extra electron is added in the formation of anion
(A) 3.9 (B) 2.8
(C) 2.6 (D) 3.5

(KL-SET DEC 2015)

70. Which of the following elements has the highest third ionization energy?
(A) Mg (B) Al
(C) Si (D) P

(KL-SET DEC 2015)

71. Lowest IP will be shown by the element having the configuration:
(A) [He] $2s^2$ (B) [He] $2s^2$ $2p^2$
(C) $1s^2$ (D) [He] $2s^2$ $2p^3$

(KL-SET 2016)

72. Which one of the following indicates the correct order of variation in atomic size?
(A) Be > C > F > Ne (B) Be > C > F < Ne
(C) Be < C < F < Ne (D) F > Ne > B > C

(KL-SET JUNE 2017)

73. The number of radial and angular nodes in a 4f orbital are respectively
(A) 3,3 (B) 2,2
(C) 0,3 (D) 0,2

(KL-SET JULY 2017)

74. The increasing order of electron affinity values among the elements C, N, O & F is
(A) N < C < O < F (B) C < N < O < F
(C) N < 0 < C < F (D) C < O < N < F

(KL SET 2018)

75. The electron gain enthalpy of halogens are in the order
(A) F > Cl > Br > I (B) F > Br > Cl > I
(C) Cl > F > Br > I (D) Cl > Br > F > I

(KL SET 2018)

76. Which is the smallest cation among the following?
(A) Na^{2+} (B) Al^{3+}
(C) Ba^{+} (D) Mg^{2+}

RAJ SET

(RAJ-SET 2012)

77. Which of the following has the highest Ionization potential:
(A) Na (B) AI
(C) Mg (D) K

(RAJ-SET 2012)

78. The screening effect is maximum for electron in:
(A) s – orbital (B) p - orbital
(C) d – orbital (D) f - orbital

(RAJ-SET 2012)

79. The inert pair effect is maximum in:
(A) N (B) P
(C) As (D) Bi

(RAJ-SET 2012)

80. Select the correct sequence of first ionization energy:
(A) Be < B < N < O (B) Be < B < O < N
(C) B < Be < O < N (D) B < Be < N < O

(RAJ-SET 2013)

81. Which order are correct?
(I) Thermal stability: $BeSO_4 < MgSO_4 < CaSO_4 < SrSO_4 < BaSO_4$
(II) Basic nature: ZnO > BeO > MgO > CaO
(III) Solubility in water: LiOH > NaOH > KOH > RbOH > CsOH
(IV) Melting point: NaCl > KCl > RbCl > CsCl > LiCl
(A) (I) and (IV) (B) (II) and (III)
(C) (I) and (III) (D) (II) and (IV)

(RAJ-SET 2013)

82. Which of the following possesses lowest value of first ionization energy?
(A) Al (B) Ga
(C) In (D) Tl

(RAJ-SET 2013)

83. The atomic number of Cr and Cu is 24, 29 and its electronic configuration is:
(A) $3d^5\ 4s^1$ and $3d^{10}4s^1$ (B) $3d^4\ 4s^2$ and $3d^{10}4s^1$
(C) $3d^5\ 4s^1$ and $3d^9 4s^2$ (D) $3d^4\ 4s^2$ and $3d^9 4s^2$

WB SET

(WB -SET)

84. The difference in the electronegativity scale between the two atom is 1.9, the nature of the bond is
(A) 75% ionic (B) 50% ionic
(C) 25% ionic (D) 100% ionic

(AP -SET 2013)

85. The correct statements among the following:
(1) Na^+ and Ne are isoelectronic but ionization energy of Na^+ is more than Ne
(2) Na^+ and Ne are isoelectronic but ionization energy of Ne is more than Na^+
(3) O^{2-} and F^- are isoelectronic but F^- has higher radius than O^{2-}
(4) O^{2-} and F^- are isoelectronic but O^{2-}has higher radius than F^-
(A) 1, 2, 3, 4 are correct (B) 1 and 3 are correct
(C) 1 and 4 are correct (D) 2 and 4 are correct

(AP -SET 2013)

86. The correct order of ionic radii of given ions:
(A) $K^+ > Ca^{2+} > Cl^- > S^{2-}$ (B) $S^{2-} > Cl^- > K^+ > Ca^{2+}$
(C) $Ca^{2+} > Cl^- > S^{2-} > K^+$ (D) $K^+ > Ca^{2+} > S^{2-} > Cl^-$

(J & K-SET 2011)

87. The second ionization energies of Li, Be, B and C are in the order:
(A) Li > C > B > Be (B) Li > B > C > Be
(C) B > C > Be > Li (D) Be > C > B > Li

(J & K-SET 2011)

88. Which of the following is the largest in size?
(A) Cl^- (B) S^{2-}
(C) Na^+ (D) F^-

(J & K-SET 2011)

89. The correct order of reducing character of alkali metals is:
(A) Rb < K < Na < Li (B) Li < Na < K < Rb
(C) Na < K< Rb < Li (D) Rb < Na < K < Li

(J & K-SET 2018)

90. Which of the following has the highest Pauling's electronegativity value?
(A) Be (B) Mg
(C) Ca (D) Ba

(WB SET 2015)

91. The correct order of stability in water is :
(A) LiI<NaI<KI<CsI (B) LiI<NaI<KI<CsI
(C) CsI>LiI>NaI>KI (D) LiI < NaI<KI<CsI

(WB SET 2015)

92. Which of the following is the correct order of Ist ionization potential:
(A) Ca>Sr>Be>Mg (B) Be>Mg>Ca>Sr
(C) Sr>Ca>Mg>Be (D) Mg>Be>Sr>Ca

(WB SET 2017)

93. For the molecule OCF_2 the correct statement is:
(A) Both ∠FCF and ∠ FCO are 120º
(B) ∠FCF > 120 but ∠ FCO<120
(C) ∠FCF < 120 but ∠ FCO>120
(d) ∠FCF and ∠ FCO > 120

(WB SET 2017)

94. An element has valence shell configurations $5d^5 6s^1$. Which group and period does it belong be?
(A) Ist Group and 6^{th} period
(B) 6^{th} group and 5^{th} period
(C) 6^{th} group and 6^{th} period
(D) 5^{th} group and 6^{th} period

(GJ SET 2003)

95. The ionic radii are:
(A) directly proportional to effective nuclear charge
(B) directly proportional to square of effective nuclear charge
(C) inversely proportional to effective nuclear charge
(D) inversely proportional to square of effective nuclear charge

(GJ SET 2004)

96. The correct order of IP of B, C, N, O are
(A) N>O>B>C (B) O>N>B>C
(C) N>O>C>B (D) O>N>C>B

(GJ – SET 2022)

97. Which of the following order is correct with respect to first ionization energies (in $KJ\ mol^{-1}$) ?
(A) $Li < K < Mg < AL$ (B) $K < Li < Al < MG$
(C) $Al < Li < Mg < K$ (D) $Li < Al < Mg < K$

ANSWER KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
C	C	D	B	B	C	D	B	A	A
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	D	C	B	D	B	D	C	D	C
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
C	D	B	A	C	D	D	C	B	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
A	C	B	B	B	B	D	C	A	A
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
A	C	C	B	C	B	C	B	D	A
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
C	B	A	B	B	C	D	B	C	A
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
C	B	C	C	D	B	C	D	D	A
71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
B	B	C	A	C	B	C	A	D	C
81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
A	D	A	B	C	B	B	B	B	A
91	**92**	**93**	**94**	**95**	**96**	**97**			
D	B	C	C	C	C	B			

:: SOLUTIONS ::

MH SET

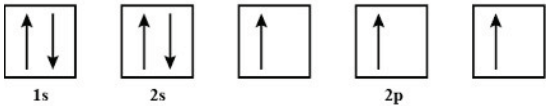
1. **Solution: (C)**

Total number of nodes for any orbital can be given by = n – 1 where n is the principal quantum number. For 3s orbital value of n is 3 so total number of orbitals is = n - 1 =2

Hence, option C is correct.

2. **Solution: (C)**

The presence of three unpaired in Nitrogen can be explained by Hund's rule. According to this rule, *electron pairing in any orbital (s, p, d or f) cannot take place until each orbital of the same sublevel contains 1 electron.* The atomic number of nitrogen is 7, so its electronic configuration will be - $1s^2\ 2s^2\ 2p^3$. 2p orbital has 3 sub-levels each of which will contain one electron. Pairing will occur only if the fourth electron is added. The distribution of electrons on the nitrogen is shown as follows:



Hence, option C is correct.

3. **Solution: (D)**

H= ½ [V+M−C+A] where,

H= Number of orbitals involved in hybridization.

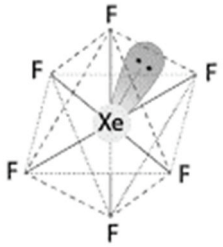
V=Valence electrons of a central atom.

M- Number of monovalent atoms linked to the central atom.

C= Charge of the cation.

A= Charge of the anion.

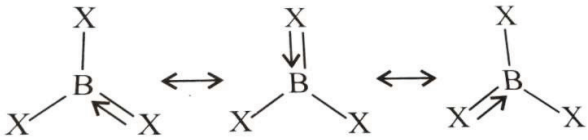
By applying the above formula, we get, the structure of XeF_6 is distorted one [sp^3d^3]. Others are perfect octahedral.



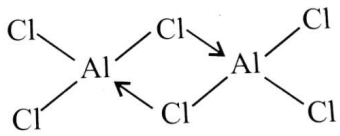
Hence, option D is correct.

4. **Solution: (B)**

Boron atom being small in size is unable to accommodate four large-sized chlorine atoms around it. However, because of its large size, Al can easily accommodate four large-sized Cl atoms around it. Since in both BCl_3 and $AlCl_3$, there are only six electrons present in the valence shell of B and Al, both are electron deficient compound. BCl_3 compounds reduce their electron deficiency by accepting a pair of electrons from the filled np orbital of the halogen atom in the vacant 2p orbital of B, thus forming pπ−pπ back bonding.



However, Al accepts a pair of electrons from 3p orbital of Cl (from another $AlCl_3$ molecule) in its vacant 3p orbital. As a result, $AlCl_3$ exist as a chlorine-bridged dimeric structure.



Hence, option B is correct.

5. **Solution: (B)**

A hydrogen bond is the electrostatic attraction between polar groups that occurs when a hydrogen (H) atom bound to a highly electronegative atom such as nitrogen (N), oxygen (O) or fluorine (F) experiences attraction to some other nearby highly electronegative atom. More electronegative the element, more is the hydrogen bonding.

Hence, the order is Cl < N < O < F

Hence, option B is correct.

6. **Solution: (C)**

The energy required to convert one Mg atom to Mg^{2+} ion is the sum of first and second ionization potentials = 7.646 + 15.035 = 22.681eV = 96.5×22.681=2188.7kJ/mol

The atomic mass of Mg is 24 g/mol and 12 mg of Mg corresponds to 0.5 millimoles.

The amount of energy required to convert 0.5 mmol of Mg atoms to Mg^{2+} ions = $0.5\times10^{-3}\times2188.7=1.1$kJ

Hence, option C is correct.

7. **Solution: (D)**

As we go down group electropositive character increases because of increases in size and hence I.E. decreases. Ba is the most electropositive element in the group and Mg is least.

So, correct order is: Mg > Ca > Sr > Ba.

Hence, option D is correct.

8. **Solution: (B)**

There are certain rules that defines the acidity and the basicity of the oxides.

All metallic oxides are basic in nature hence, Na_2O is more basic in nature. *Metal oxides which react with both acids as well as bases to produce salts and water are known as amphoteric oxides.* Many metals (such as zinc, tin, lead, aluminum, and beryllium) form amphoteric oxides or hydroxides.

All nonmetallic oxides are acidic in nature hence, acidic oxides are NO_2, CO_2.

Deciding between CO_2 and NO_2, we have carried out the hydrolysis reaction of both which produces H_2CO_3 [less acidic] and HNO_3 [more acidic] and hence correct order is $CO_2<NO_2<Al_2O_3<Na_2O$

Hence, option B is correct.

9. **Solution: (A)**

On moving down the group, the ionization enthalpy decreases. This is true for B and Al. The ionization enthalpy of Ga is unexpectedly higher than that of Al. Ga contains 10 d electrons in inner shell which are less penetrating. Their shielding is less effective than that of s and p electrons. The outer electron is held fairly strongly by the nucleus. The ionization enthalpy increases slightly. A similar increase is observed from In to Tl due to presence of 14f electrons in the inner shell of Tl which have poor shielding effect. Hence the order is, B > Tl > Ga > Al > In

Hence, option A is correct.

10. **Solution: (A)**

Valinomycin is a naturally occurring compound in living beings used in the transport of potassium. It is highly selective for potassium ions over sodium ions within the cell membrane. It functions as a potassium-specific transporter and facilitates the movement of potassium ions through lipid membranes down the electrochemical potential gradient.

Hence, option A is correct.

11. **Solution: (A)**

From left to right, Atomic size decreases due to increase in effective nuclear charge and from top to bottom, atomic size increases due to increase in principal quantum number. Hence the order is given as: Si > P > S > Cl

Hence, option A is correct.

12. **Solution: (D)**

A hydrogen bond is the electrostatic attraction between polar groups that occurs when a hydrogen (H) atom bound to a highly electronegative atom such as nitrogen (N), oxygen (O) or fluorine (F) experiences attraction to some other nearby highly electronegative atom. *More electronegative the element, more is the hydrogen bonding.* Also, the chlorine atom is too large. Despite its electronegativity, the size of the atom is such that its electron density is too low to form hydrogen bonds. This is why Chlorine does not display hydrogen bonding while nitrogen does. The correct order of the electronegativity is Cl < N < O and hence, (i) > (iii) > (ii)

Hence, option D is correct.

13. **Solution: (C)**

Hardness of the compound depends upon the size [atomic and ionic radius]. *Smaller is the radius, smaller is the size and harder is the base which shows higher HOMO-LUMO gap.* In the given question, size follows the order as, $CH_3^- > NH_2^- > OH^- > F^-$ and hence, the correct order of the hardness is $CH_3^- < NH_2^- < OH^- < F^-$

Hence, option C is correct.

GUJARAT SET

14. **Solution: (B)**

There are total four quantum numbers. Their values can be given in the following manner:

Quantum Number	Symbol	Possible values
Principal quantum number	n	1,2,3,4…….
Azimuthal quantum number	l	0,1,2,3,4…….(n-1)
Magnetic quantum number	m_l	*-l,……,-1,0,1,…..+l*
Spin quantum number	m_s	+1/2, -1/2

All the SETs given above in the option, only n = 2, l = 1, m = 0, s = +1/2 matches with the above table

Hence, option B is correct.

15. **Solution: (D)**

Van der Waals forces include attraction and repulsions between atoms, molecules, and surfaces, as well as other intermolecular forces. The order of van der Waals interaction present in the halogens is given as $F_2 < Cl_2 < Br_2 < I_2$. This is the same order as that for the increase in the atomic size. Higher is the atomic size, higher will be the van der Waal's force.

Hence, option D is correct.

16. **Solution: (B)**

When one or more of the bonding pairs of electrons is replaced with a lone pair, the molecular geometry (actual shape) of the molecule is altered or contracted. The bond angle in the tetrahedral CH_4 molecule is 109.5°. Again, the replacement of one of the bonded electron pairs with a lone pair compresses the angle slightly. The H−N−H angle is approximately 107°. In the water molecule, two of the electron pairs are lone pairs rather than bonding pairs. The molecular geometry of the water molecule is bent. The H−O−H bond angle is 104.5°, which is smaller than the bond angle in NH_3.

Hence, option B is correct.

17. **Solution: (D)**

I is stabilized by resonance while II is not. As I is stabilized by resonance it will have less nucleophile character than II. I will react slower than II.

18. **Solution: (C)**

Second ionization potential is the amount of energy required to remove an electron from the outer shell of unipositive ion and the electronic configuration of unipositive ions is as follows

$C^+(5) = 1s^2, 2s^2, 2p^1$ and $N^+(6) = 1s^2, 2s^2, 2p^2$

$O^+(7) = 1s^2, 2s^2, 2P^3$ and $F^+(8) = 1s^2, 2s^2, 2p^4$

In O^+, half-filled p-orbital is present, so its second ionization potential is greater than that of F^+. Thus, the correct is O > F > N > C.

Hence, option C is correct.

19. **Solution: (C)**

A valence-electron in a multi-electron atom is attracted by the nucleus and repelled by the electrons of inner-shells. The combined effect of this attractive and repulsive force acting on the valence-electron experiences less attraction from the nucleus. This is called shielding or screening effect. In Cl, there are empty d-orbitals where it can accommodate its electron and because of this, attraction forces increase and electron affinity also.

Hence, option C is correct.

20. **Solution: (C)**

In the structure of ice, due to Hydrogen bonding each molecule of H_2O is surrounded by three H_2O molecules in hexagonal honey comb manner. So due to large empty space voids are present in ice. When ice melts, density increases as water molecules come closer together to filling up empty spaces.

In the structure of ice each molecule of H_2O is surrounded by three H_2O molecules in hexagonal honey comb manner. Whereas in water, each molecule is surrounded by four neighboring molecules randomly which results in an open cage − like structure. As a result, there are a number of ' hole ' or open spaces are present in ice. When ice melts a large number of hydrogen bonds are broken. The molecules of H_2O occupy the holds or open spaces and come closer to each other than they were in solid state. This results in sharp increase in the density. Therefore, ice has lower density than water at 4^0C

Hence, option C is correct.

21. **Solution: (C)**

The concept of dissociation energy depends upon the concept of bond order, bond strength and bond length. *Higher is the bond order, stronger is the bond strength, shorter is the bond length and largest is the bond dissociation energy.* From the options given above, bond order of CN^- is the largest (3) than BN (2), CN (2.5) and NO (2.5) and hence it has the largest dissociation energy.

Hence, option C is correct.

22. **Solution: (D)**

Generally, *As the Z_{eff} increase in a period for left to right direction so the radius decreases.* But in the case of Nobel gases, the van der Waal's radius is much larger than other elements. This is because of the more electron-electron repulsion. In a group radius increase down the group. So, the order is-

F < Cl < O < N < Ne

Hence, option D is correct.

23. **Solution: (A), (B)**

The radial part of wave function which relates to the position of an electron at a specific point depends on the principal quantum number and azimuthal quantum number.

Hence, option A and B both are correct.

24. **Solution: (A)**

Ionic character can be calculated by formula:

% ionic character = $16[E_A - E_B] + 3.5[E_A - E_B]^2 = 16[2.5 - 1.05] + 3.5[2.5 - 1.05]^2 = 28.80\%$

Hence, option A is correct.

HP SET

25. **Solution: (C)**
All carbon atoms have six protons, and most have six neutrons as well. But some carbon atoms have seven or eight neutrons instead of the usual six. ... Different isotopes of an element generally have the same physical and chemical properties because they have the same numbers of protons and electrons.
Hence, option C is correct.

26. **Solution: (D)**
For 4d orbital,
Angular nodes=l=2 for d-orbital
Radial node=n-l-1=4-2-1=1
Hence, option D is correct.

KARNATAKA SET

27. **Solution: (D)**
The distribution of electrons in these molecular orbitals by filling the orbitals in the same way that we fill atomic orbitals.
Hence, option D is correct.

AP SET

28. **Solution: (C)**
Elements X, Y and Z with atomic numbers 19, 37, 55 lie in group 1 (alkali metals). Within a group, IE decreases from top to bottom. Therefore, IE of Y could be between those of X and Z.
Hence, option C is correct.

29. **Solution: (B)**
P has higher ionisation energy than S as P has a half-filled 3p subshell. Removal of an electron from P atom will break the stability of half-filled subshell.
Hence, option B is correct.

30. **Solution: (B)**
No of radial nodes in 3s
$= n - l - 1 = 3 - 0 - 1 = 2$
Hence, option B is correct.

31. **Solution: (A)**
Moving right in the periodic table results in an increase in electronegativity and a decrease in electronegativity if we move downwards
Be being on the top right expected to have a maximum value of electronegativity
Hence, option A is correct.

32. **Solution: (C)**
Orbital angular momentum is denoted by l while magnetic quantum no which defines the orbitals is denoted by m. Spin quantum no which is ½ or -1/2 for an electron is denoted by S Total angular quantum no is denoted by J
Hence, option C is correct.

33. **Solution: (B)**
Decrease in electronegativity is observed if we move downwards. And greater the electronegativity greater would be the amount of energy required to remove an electron from the outermost shell and hence greater would be the ionization energy.
Hence, option B is correct.

34. **Solution: (B)**
3d atomic orbital,
Radial nodes =n-l-1=3-2-1=1
Angular nodes=l=2
Hence, option B is correct.

JAMMU KASHMIR SET

35. **Solution: (B)**
o know about the second ionization energy of the given atoms we are supposed to know the electronic configuration of the given atoms.
- The atomic number of lithium is 3 and the electronic configuration of the lithium is $1s^2\,2s^1$
- The atomic number of beryllium is 4 and the electronic configuration of the beryllium is $1s^2\,2s^2$
- The atomic number of boron is 5 and the electronic configuration of the boron is $1s^2\,2s^1\,2p^1$
- The atomic number of carbon is 6 and the electronic configuration of the carbon is $1s^2\,2s^1\,2p^2$

After removing one electron from the given elements the electronic configuration of the given elements will be as follows.
- Electronic configuration of the lithium (+1) is $1s^2 2s^0$.
- Electronic configuration of the beryllium (+1) is $1s^2 2s^1$.
- Electronic configuration of the boron (+1) is $1s^2 2s^2 2p^0$.
- Electronic configuration of the carbon (+1) is $1s^2 2s^2 2p^1$

Hence the order will be:
Li > B > C > Be
The second ionization energy for lithium is very high because the electronic configuration of Li (+1) resembles the electronic configuration of the stable noble gas. Boron also has filled 2s orbital after losing one electron. So, boron has high second ionization energy.
Hence, option B is correct.

36. **Solution: (B)**

$2Cu^{2+}+4I^{-}\rightarrow 2CuI_2 2Cu^{2+}+4I^{-}\rightarrow 2CuI_2$

The CuI_2 immediately decomposes to liberate I2 and insoluble copper (I) iodide.

2CuI2→2CuI+I2

Hence, option B is correct.

37. **Solution: (D)**

In nth shell, the total number of orbitals are n^2 where each orbital can occupy a maximum of two electrons with opposite spin quantum number as +1/2 and -1/2. Hence max will be $2n^2$ Rest of the three quantum numbers in a given orbital will be same.

Thus it will follow Pauli's exclusion principle.

Hence, option D is correct.

38. **Solution: (C)**

The correct order of electron gain enthalpy with negative sign of F, Cl, Br, and I is Cl>F>Br>I Actually halogens have maximum electron gain enthalpy in the corresponding periods and it becomes less negative down the group. However, the negative electron gain enthalpy of fluorine is less than that of chlorine.

Hence, C is the correct option.

39. **Solution: (A)**

Properties of elements are a periodic function of their atomic number. 'Let us recall that the atomic number gives us the number of protons in the nucleus of an atom and this number increases by one in going from one element to the next. Atomic no is given by the no of protons and electrons. Now in nucleus, protons are present so, the correct option is A

40. **Solution: (A)**

Highest electron affinity will be of oxygen because as we move down the group, the size increases and hence the attraction of nucleus for electron also decreases.

Hence, the correct option is A

41. **Solution: (A)**

Electronegativity of atoms change less rapidly when crossing the d-block of elements than when crossing the p-block. This is due to the higher screening effect of penultimate d electrons. Hence, the increase in the effective nuclear charge is more gradual for d block elements.

Hence the correct option is A

42. **Solution: (C)**

Since Rb belongs to the first group of the periodic table and Ba belongs to the second period, hence the reaction between the two is not possible. The first metal has +1 valency while the period 2 metal while have +2 valency.

Hence the correct option is C

43. **Solution: (C)**

The no of radial nodes=n-l-1

3s=3-0-1=2

Hence the correct option is C

44. **Solution: (B)**

Generally, ionization energy increases with atomic number in a period as we move from left to right. But as P has the stability of half-filled 'p' orbital, it has greater ionization energy than S which has 4 electrons in 3p level and would readily lose the extra electron to acquire the stable half-filled 3p orbital.

Hence the correct option is B

45. **Solution: (C)**

Orbital angular momentum is denoted by l which defined the type of orbital present. L=0-s

L=1-p

L=2-d

Magnetic quantum no is denoted by M quantum no

Spin quantum no is denoted by S

Total angular momentum is denoted by J

Hence the correct option is C

46. **Solution: (B)**

While moving down the group, the electronegativity increases, with this increase the atoms try to keep their electrons to themselves and hence more ionization energy is required to remove the outermost electrons, hence an increase in I.E is observed.

Hence the correct option is B

47. **Solution: (C)**

The radius of Fe^{3+} is lower than that of Fe^{2+} because the greater the charge, the greater would be the effective nuclear charge experienced and hence smaller radius.

Hence the correct option is C

48. **Solution: (B)**

To achieve the stable half-filled d orbital configuration, only 1 electron is occupied by s orbital and 5 electrons are occupied by d-orbital.

[Ar] $3d^5 4s^1$

Hence the correct option is B

KA SET

49. **Solution: (D)**

A) E.N.: F>Cl>Br - Electronegativity decreases down the group and F is the most electronegative element.

B) E.A.: Cl>Br<F - Electron affinity of fluorine is less than that of chlorine because of small size of F atom. As a result, there is strong interelectronic repulsion in the relatively small 2p orbitals of F and thus, the incoming electron does not experience much attraction.

Flourine is stronger oxidising agent than chlorine because low bond dissociation energy of F–F bond and high hydration enthalpy of F^-

Bond energy $F_2>Cl_2>Br_2$ is wrong because low bond dissociation energy of F–F bond than Cl–Cl.

Hence the correct option is D

50. **Solution: (A)**

Electronegativity depends on the number of electrons required to get octet configuration. It increases from left to right in a period, hence correct order is F>O>N>C.

Hence the correct option is A

51. **Solution: (C)**

On moving down the group, in main group elements the ionization energy regularly decreases due to the following factors.

(i) Atomic size: On moving down the group, as additional shells are added, the atomic size increases.

(ii) Shielding effect: As the number of inner electrons increases, the shielding effect on the outermost electrons increases.

(iii) Nuclear charge: On moving from top to down in a group, the nuclear charge increases. The effect of increase in the atomic size and the shielding effect is much more significant than the nuclear charge. The electron becomes less lightly held to the nucleus on moving down the group. Due to this, the ionization enthalpies gradually decrease on moving down the group. In non-transition elements.

Hence the correct option is C

52. **Solution: (B)**

Sodium and chlorine atoms come together to form sodium chloride (NaCl). NaCl is an ionic compound because of the strong electrostatic forces of attraction between positively charged Na metal cations and negatively charged Cl non-metal anions.

Carbon disulfide (CS_2) is made by the reaction of carbon and Sulphur. Since electronegativity of C and S is almost same so it is a covalent compound.

Sulphur reacts with oxygen to give Sulphur dioxide (SO_2). Sulfur dioxide bond is of covalent bonding since Sulphur and oxygen are both non-metals.

Calcium hydride (CaH_2) is an ionic compound that is formed when calcium metal reacts with hydrogen gas.

Hence the correct option is B

53. **Solution: (A)**

Electronegativity varies in a predictable way across the periodic table. Electronegativity increases from bottom to top in groups, and increases from left to right across periods. Thus, fluorine is the most electronegative element, while francium is one of the least electronegative.

Hence the correct option is A

54. **Solution: (B)**

55. **Solution: (B)**

Due to stable fully filled p-orbital the neon molecule does not want to lose electrons easily. Therefore, its first ionization potential is high. Also in sodium, the first ionization energy would be low as it would lead to stable inert gas configuration.

Hence option B is correct answer.

56. **Solution: (C)**

In nitrogen, the first ionization energy would be very high as the electron is to be removed from stable half-filled p-orbital.

Hence the correct option is C

57. **Solution: (D)**

ZnS is soluble in acidic solution. Hence, it cannot be precipitated from acidic solution. However, it can be precipitated from alkaline solution and to some extent from neutral solution. CuS and PbS can be precipitated from acidic solution.

Thus, the treatment of hydrogen sulfide with a solution containing ions of copper, zinc and lead will precipitate CuS and PbS.

Hence the correct option is D

58. **Solution: (B)**

The electronic configuration of xenon is-

$[Kr]\ 4d^{10}\ 5s^2\ 5p^6$

In excited state, the two electrons in 5p are excited to higher energy 5d orbital.

Hence the correct option is B

KL SET

59. **Solution: (C)**

Radial nodes =n-l-1

For 3s=3-0-1=2

60. **Solution: (A)**

Potassium sodium tartrate tetrahydrate, also known as Rochelle salt, is a double salt of tartaric acid, and hence an organic acid.

Hence the correct option is A

61. **Solution: (C)**
Electronic configuration is [Ar] $4S^2d^{10}$
It readily loses $4s^2$ electrons to form X^{2+}
. Hence formula of oxide is $X^{2+}O^{2-}$=XO.
We can see that the metal is Zn. ZnO reacts with acid as well as base. Hence the nature of oxide is amphoteric.
Hence the correct option is C

62. **Solution: (B)**
Two nuclides are isotones if they have the same neutron number N, but different proton number z. For example, Boron 12 and Carbon-13 nuclei both contain 7 neutrons and so are isotones
Hence the correct option is B

63. **Solution: (C)**
Oxygen and nitrogen are not greenhouse gases, because they are transparent to infrared light. These molecules are invisible because when you stretch one, it doesn't change the electric field.
Hence the correct option is C

64. **Solution: (C)**
The size of an element within a period decreases from left to right up to halogens because of the net increase in nuclear charge on the outermost electron. From halogen to noble gases the size increases as the last electron completes the octet and compensates for the increase in nuclear charge. Be is at the extreme left and hence will have larger size. Therefore, among B, C, N, Be, the size will follow the order:
Be>C>F<N
Hence the correct option is C

65. **Solution: (D)**
Arsenic is the third element in the fifteenth column of the periodic table. It is classified as a metalloid because it has some properties similar to a metal and others of a non-metal. Arsenic atoms have 33 electrons and 33 protons with 5 valence electrons in the outer shell.
Hence the correct option is D

66. **Solution: (**A**)**
Electronic configuration of,
$O_8 \rightarrow 1s^2 2s^2 2p^4$
$F_9 \rightarrow 1s^2 2s^2 2p^5$
$N_7 \rightarrow 1s^2 2s^2 2p^3$
$C_6 \rightarrow 1s^2 2s^2 2p^2$
$2nd\ I.E. \rightarrow$
$O^- \rightarrow 1s^2 2s^2 2p^3$
$F^- \rightarrow 1s^2 2s^2 2p^4$
$N^- \rightarrow 1s^2 2s^2 2p^2$
$C^- \rightarrow 1s^2 2s^2 2p^1$
Oxygen having half-filled configuration is most stable and will require high energy to remove an e− followed by fluorine being the most electronegative element, then followed by N which is less electronegative than F but more than C.
∴ Order of second ionization enthalpy is O>F>N>C
Hence the correct option is B

67. **Solution: (C)**
BE per nucleon $O^{16} = 7.97MeV$
BE per nucleon $O^{17} = 7.75eV$
$O^{17} \rightarrow n_0^1 + O^{16}$
$energy\ required\ to\ remove\ neutron$
$= 17 \times 7.75 - 16 \times 7.97 = 4.23MeV$
Hence the correct option is C

68. **Solution: (D)**
Total no of nodes=5f orbital
Nodes =n-1=5-1=4
Hence the correct option is D

69. **Solution: (D)**
When an extra electron is added in nitrogen atom, added electron will be screened by five electrons in second orbit ($2s^2\ 2p^3$) and two electrons in first orbit ($1s^2$).
Now screening constant, σ=5×0.35 in nth orbit+2×0.85 in (n−1) th orbit=1.75+1.70=3.45
∴ Effective nuclear charge =7−3.45=3.55.
Hence the correct option is D

70. **Solution: (A)**
Electronic configuration of Mg is- $1s^2 2s^2 2p^6 3s^2$
Because the third ionization energy involves the removal of a 2p electron, from fully filled p-orbital that is more closely bound to the nuclear core, this electron should require more energy to remove.
Hence the correct option is A

71. **Solution: (B)**
In case of he, electron is to be removed from fully filled 2s orbital, similarly in $1s^2$ electron is to be removed from fully filled 1s while in the D option, e is to be removed from highly stable half-filled electronic configuration.
Hence the correct option is B

72. **Solution: (B)**
The size of an element within a period decreases from left to right up to halogens because of the net increase in nuclear charge on the outermost electron. From halogen to noble gases the size increases as the last electron completes the octet and compensates for the increase in nuclear charge. Therefore among B, C, F, Ne, the size will follow the order:

B>C>F<Ne

Hence the correct option is B

73. **Solution: (C)**

Radial nodes=n-l-1=4-3-1=0

Angular nodes=l=3

In 4f orbital

Hence the correct option is C

74. **Solution: (A)**

The correct sequence of the electron affinity of C,N,O and F is C>N<O<F. The electron affinity of C is greater than that of N. The electronic configurations of C and N are $1s^2 2s^2 2p^2$ and $1s^2 2s^2 2p^3$ respectively. In case of N, the 2p orbital is half filled and stable.

Hence the correct option is A

75. **Solution: (C)**

Electron gain enthalpy becomes less negative on moving down a group due to increase in atomic size. However, the electron gain enthalpy of F is less negative than that of Cl due to electron-electron repulsion in small-sized F atom. Thus, the correct order is F<Cl>Br>I.

F, Cl, Br and I have Δeg H values(in kJmol $^{-1}$) -328, -349, -325 and -295 respectively.

Hence the correct option is C

76. **Solution: (B)**

The cations Na^+, Mg^{2+}, Al^{3+} have 10e each. Ca^{2+} has 18e and hence is larger than the three.

Al^{3+} will have the smallest size. This is because the effective nuclear charge is most in this case and hence the electrons are attracted closer to the nucleus.

Hence the correct option is B

RAJ SET

77. **Solution: (C)**

Mg has electronic configuration-$1s^2 2s^2 2p^6 3s^2$, since the electron is to be removed from fully filled 2s electronic configuration, hence will have highest ionization potential.

Hence the correct option is C

78. **Solution: (A)**

The shielding effect can be defined as a reduction in the effective nuclear charge on the electron cloud, which is due to a difference in the attraction forces on the electrons in the atom. The s orbital has the greatest effect to reduce the force of attraction between the outermost electron and nucleus due to its effective charge density followed by p > d > f. According to orbital order, S orbital is closest to the nucleus followed by the P orbital, D orbital and finally the F orbital.

So, as per the screening effect, S orbital being close to the nucleus lacks screening from any other orbital as it is the first and the closest orbital.

Hence the correct option is A

79. **Solution: (D)**

The inert pair effect decreases down a group, Bi will experience the maximum because the inert pair effect is the tendency of two Electrons in the outermost atomic orbital to remain unshared. The Electrons present in the intervening d-(and f-) orbitals do not effectively shield the s-electrons of the violence shell down the group. As a result, the inert pair of s Electrons remains more tightly held by the nucleus and hence participates less in bond formation.

Hence the correct option is D

80. **Solution: (C)**

N will have the maximum ionization energy

$1s^2 2s^2 2p^3$ because it will require maximum energy to remove an e from stable half-filled electronic configuration.

B will have the lowest ionization energy, $1s^2 2s^2 2p^1$ because on removing the e from p orbital, stable fully filled configuration will be achieved.

Hence the correct option is C

81. **Solution: (A)**

Comparison of melting points of ionic compounds is generally done by considering the following two factors:

Charge of the cation/anion: More the charge of cation or anion, stronger will be the forces of attraction between the ions and higher will be the melting point.

Ionic radii: More the distance between ions, lesser will be the strength of the bond giving rise to lesser melting point.

Going by the above rules, the order should have been: LiCl>NaCl>KCl>RbCl

(Since charges of the ions are same for each molecule and cationic radius increases down the group.)

But LiCl, due to excessive polarization (Fajans' rules), exhibits high covalent character and is placed last in the order. Hence, the new order would be:

NaCl>KCl>RbCl>LiCl

Hence the correct option is A

82. **Solution: (D)**

We know that the ionization energy decreases from top to bottom in a group. This is because as we move down the group, the atomic size increases and hence the force of attraction towards the valence electrons decreases.

In the above scenario, thallium has the least ionization energy compared to the other elements.

Hence the correct option is D

83. **Solution: (A)**

Cr acquires

$4s^1 3d^5 configuration\ so\ as\ to\ achieve$ half filled d-configuration while Cu acquires

$4s^1 3d^{10}\ configuration\ so\ as\ to\ achieve$ fully filled d-configuration which is highly stable.

Hence the correct option is A

WB SET

84. **Solution: (B)**

If the electronegative difference is >1.7 then its nature is ionic and <1.7 then its nature is covalent and if its equal to 1.7 then nature of bond will be 50% ionic and 50% covalent.

Hence the correct option is B

85. **Solution: (C)**

Na^+ and Ne have the same electrons that is 10 but Na being positive ion will exhibit more effective nuclear charge and hence its radius will be low.

Similarly, O^{2-} and F- have same electrons that is 10 but $O^{(2-)}$ having more negative charge will have higher size because of more polarization.

Hence the correct option is C

86. **Solution: (B)**

These are isoelectronic species. They have same number of electrons (10 electrons in each ion). Ca^{2+} has max positive charge that is of 20 protons and hence will pull e more inside thus implying smaller radius.

Similarly, S^{2-} has lowest protons 16, hence will be less effectively pulled by nucleus.

Hence the correct option is B

87. **Solution: (B)**

The ionization energy is the energy required to remove an electron from the outermost shell of an isolated gaseous atom. When the first electron or the most loosely bound electron is removed, the amount of energy required is less than the energy required to remove the electron in the next successive shell. This ionisation energy goes on increasing with the number of electrons removed.

So the number of electrons removed from the successive no of shells and the energy involved is called successive ionization energy.

The second ionization energy is the energy required to remove an electron from a 1+ cation in the gaseous state. Just like the first ionization energy, the second ionization energy is affected by size, effective nuclear charge, and electron configuration.

The order is Be<C<B<Li

Hence the correct option is B

88. **Solution: (B)**

These are isoelectronic species. They have same number of electrons. S^{2-} has lowest protons 16, hence will be less effectively pulled by nucleus and hence the largest size.

Hence the correct option is B

89. **Solution: (B)**

Li has the most negative E° value while E° values of other alkali metal become more and more negative as we, move down the group from Na to Rb.

Hence the correct option is B

90. **Solution: (A)**

Electronegativity increases across a period because of the number of charges on the nucleus increases. That attracts the bonding pair of electrons more strongly. It decreases along a group because the no of charges on nucleus is decreasing. Hence, Be will have maximum electronegativity.

Hence the correct option is A

91. **Solution: (D)**

Among alkaline earth metal hydroxides, the anion being common, the cationic radius will influence the lattice enthalpy. Since lattice enthalpy decreases much more than the hydration enthalpy with increasing ionic size, the solubility increases down the group ($|\downarrow$).The size of anions being much larger as compared to cations, the lattice enthalpy will remain almost constant within a particular group. Since the hydration enthalpy decreases down the group, solubility will decreases as found for alkaline earth metal carbonates and sulphates.

Hence the correct option is D

92. **Solution: (B)**

As we move down the group, size increases. The smallest size Be will have maximum effect nuclear charge and hence the highest ionization enthalpy that is the energy required to remove an outermost electron.

Hence the correct option is B

93. **Solution: (C)**

S-character is directly proportional to Bond angle i.e.

S-character α Bond Angle

Combination of S & P orbitals gives rise to Hybrid orbitals and more the s-character of a Hybrid molecule has, the greater the angle between their bond.

As F is more electronegative than O, so %S in C-F bond decreases hence ∠FCF bond angle also decreases.

Hence, ∠ FCO>120 and ∠FCF < 120.

Hence the correct option is C

94. **Solution: (C)**

The last shell will indicate the period while n+1 of the previous shell will indicate the group of the element in periodic table.

Hence the correct option is C

95. **Solution: (C)**

The radius of the ion depends on the effective nuclear charge, more the charge, more heavily the electrons are attracted towards the center and lesser in the size. Hence the ionic radii are inversely proportional to effective nuclear charge.

Hence the correct option is C

96. **Solution: (C)**

The 1st Ionization Potential increases across a period as atomic size decrease. Given elements are Be, B, C, N, O.

1st Ionization Potential order is B<C<O<N.

Hence the correct option is C

97. **Solution: (B)**

Ionization energy decreases down the group but increases from left to right in a period. So $K < Na < Al < Mg$ is the correct order of ionization energy potassium is present in the fourth period. Sodium, aluminum & magnesium.

Hence the correct option is B.

CHEMICAL BONDING

CHAPTER 2

MH SET

(MH-SET 2011)

1. The bond angles in H_2O are:
   (A) <109° (B) 109°
   (C) 120° (D) 180°

(MH-SET 2011)

2. Which one of the following compounds is practically insoluble in water?
   (A) $CaCl_2$ (B) CaF_2
   (C) MgI_2 (D) $BaCl_2$

(MH-SET 2011)

3. The H-A-H bond angle in the following hydrides with general formula AH_3 follows the order:
   (A) $AsH_3 > PH_3 > NH_3$ (B) $PH_3 > AsH_3 > NH_3$
   (C) $NH_3 > AsH_3 > PH_3$ (D) $NH_3 > PH_3 > AsH_3$

(MH –SET 2013)

4. In which of the following bonds does H carry δ-ve charge?
   (A) F-H (B) O-H
   (C) B-H (D) N-H

(MH – SET 2020)

5. Which of the following statements regarding solubility of LiF and LiI in water at room temperature is correct?
   (A) Both are equally soluble
   (B) Both are insoluble
   (C) LiF is more soluble than LiI
   (D) LiI is more soluble than LiF

GUJARAT SET

(GJ-SET 2014)

6. Amongst (I) NH_3; (II) $N(CH_3)_3$ and (III) $N(SiH_3)_3$ Predict the order of basicity from the SETs mentioned below. (Hints: (I) and (II) have pyramidal and (III) is trigonal planar structure.)
   (A) (II) > (III) > (I) (B) (II) > (I) > (III)
   (C) (III) > (II) > (I) (D) (I) > (II) > (III)

7. What is bond angle in nitrogen trichloride?
   (A) 120° (B) 190.5°
   (C) 107.5° (D) 90°

(GJ-SET 2018)

8. The bond angle of Cl_2O is ……
   (A) Smaller than that of F_2O
   (B) Greater than that of H_2O
   (C) Smaller than that of H_2O
   (D) Same as that of H_2O

(GJ-SET 2019)

9. Identify the correct sequence which represents the increasing order of polarizing power of the cationic species: K^+, Ca+, Mg^{2+}, Be^{2+}:
   (A) $K^+ < Mg^{2+} < Ca^{2+} < Be^{2+}$ (B) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$
   (C) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$ (D) $Mg^{2+} < Be^{2+} < K^+ < Ca^{2+}$

(GJ-SET 2002)

10. Which of the following have identical bond orders
    (A) N_2 and O_2^- (B) N_2 and O_2
    (C) N_2 and O_2^+ (D) NO and O_2^+

(GJ-SET 2003)

11. Which of the following d orbital involve in dsp^2 hybridization:
    (A) d_{xy} (B) d_x^2
    (C) d_{x2-y2} (D) d_{xy}

(GJ – SET 2022)

12. Identify the correct pair of having most basic and acidic nature, respectively.
    (A) Cr_2O_3, CrO_3 (B) CrO_3, Cr_2O_3
    (C) CrO, CrO_3 (D) CrO_3, CrO

(GJ – SET 2022)

13. The enthalpies of hydration of $Li, Na, K, Rb\ ions$ follow the order as
    (A) $Li < Na < k < Rb$ (B) $Na > Li < k > Rb$
    (C) $Li > Na > K > Rb$ (D) $Rb < Na > K > Li$

HP SET

(HP-SET 2014)

14. Which of the following molecules or ions is not linear?
    (A) $BeCl_2$ (B) ICl_2^-
    (C) CS_2 (D) ICl_2^+

(HP-SET 2014)

15. The hybridization of atomic orbitals of N in NO_2^+, NO_3^- and NH_4^+ are respectively: -
(A) sp, sp^2 and sp^3 (B) sp, sp^3 and sp^2
(C) sp^2, sp and sp^3 (D) sp^2, sp^3 and sp

(HP-SET 2014)

16. The strength of bonds by overlapping of atomic orbitals is in the order: -
(A) s-s > s-p > p-p (B) s-s < p-p < s-p
(C) s-p < s-s < p-p (D) p-p < s-s < s-p

(HP-SET 2014)

17. Which of the following is not stable?
(A) H_2^+ (B) H_2
(C) He_2 (D) HHe

(HP-SET 2014)

18. Compound X is highly volatile and insoluble in H_2O. Bonding in X is:-
(A) Ionic (B) Covalent
(C) Polar covalent (D) Coordinate

(HP-SET 2014)

19. The compound NH_3-BF_3 can be easily separated into its compound because: -
(A) BF_3 is highly reactive
(B) NH_3 is highly reactive
(C) BF_3 and NH_3 are unstable
(D) BF_3 and NH_3 have their independent existence

(HP-SET 2014)

20. The hybrid orbital of the central atom in AlF_4^- is: -
(A) sp (B) sp^2
(C) sp^3 (D) dsp^2

(HP-SET 2014)

21. Which one of the following is not an s-block element?
(A) [Ar] $4s^2\ 3d^{10}\ 4p^6\ 5s^1$ (B) $1s^2\ 2s^2\ 2p^1$
(C) $1s^2\ 2s^1\ 2p^1$ (D) [Ar] $4s^1\ 4p^1$

(HP-SET 2014)

22. Which one of the following cannot be used to generate H_2?
(A) Al + NaOH (B) Zn + NaOH
(C) Mg + NaOH (D) LiH + H_2O

(HP –SET 2019)

23. Arrange in order of increasing dipole moment BF_3, H_2S, H_2O
(A) $BF_3 < H_2S < H_2O$ (B) $H_2S < H_2O < BF_3$
(C) $H_2S < BF_3 < H_2O$ (D) $H_2O < H_2S < BF_3$

KARNATAKA SET

(KA-SET 2020)

24. The total number of electrons in a molecule of phosphoric acid are:
(A) 50 (B) 48
(C) 52 (D) 51

(KA-SET 2013)

25. The point group symmetry of $XeOF_4$ is:
(A) D_3h (B) D_4v
(C) C_4v (D) C_3v

(KA –SET 2014)

26. ^{19}F NMR spectrum of PF_5 gives
(A) Two singlets
(B) A doublet and a triplet
(C) Two doublets and three singlets
(D) A doublet

(KA –SET 2014)

27. Assertion (A): BeH_2 is linear and H_2O bent.
Reason (R): The major difference between BeH_2 and H_2O is the number of valence electrons on central atom.
(A) Both A and R are true, but R is not the correct explanation
(B) Both A and R are true and R is the correct explanation
(C) A is true but R is false
(D) A is false but R is true

(KA-SET 2015)

28. Identify the non-planar species among
(A) SO_3 (B) NO_3^-
(C) CO_3^{2-} (D) SO_3^{2-}

29. Which among the following is the best fluorinating agent?
(A) XeF_2 (B) XeF_4
(C) XeF_6 (D) XeO_2F_4

(KA-SET 2015)

30. XeF_6 is hydrolyzed to give
(A) $XeOF_4$ (B) XeO_2F_2
(C) XeO_3 (D) XeO_2

(KA-SET 2016)

31. Assuming ClF_3 to be stereochemical rigid, its ^{19}F NMR spectrum (I for ^{19}F=1/2) would be (ignore any NMR activity of Cl):
(A) A doublet and triplet for a T-shaped structure
(B) A single for a trigonal planar structure
(C) A double and a singlet for a T-shaped structure
(D) Two singlets for a trigonal pyramid structure

(KA-SET 2016)

32. Numbers of geometric isomers of PBr_2Cl_3 molecule which have non-zero dipole moment are:
(A) 2 (B) 1
(C) 0 (D) 3

(KA-SET 2017)

33. Molten iodine conducts electricity because of the formation of:
(A) $I_2 + I_3^-$ (B) $I_3^+ + I_3^-$
(C) I_3^+ (D) I_3^-

(KA-SET 2017)

34. Number of lone pairs of electrons present in SF_4, CF_4 and XeF_4 are
(A) 1, 0, 2 (B) 2, 0, 2
(C) 1, 0, 1 (D) 0, 0, 2

AP SET

(AP-SET 2012)

35. The most stable among the following is
(A) LiF (B) LiI
(C) HgF_2 (D) BeI_2

(AP -SET 2013)

36. Correct order of bond angles in given molecules
(A) $H_2S > H_2Se > H_2O$ (B) $H_2Se > H_2O > H_2S$
(C) $H_2O > H_2Se > H_2S$ (D) $H_2O > H_2S > H_2Se$

(AP -SET 2013)

37. According to Bent's rule
(1) More electronegative substituents prefer hybrid orbitals having more S character
(2) More electronegative substituents prefer hybrid orbitals having less S character
(3) More electropositive substituents prefer hybrid orbitals having more S character
(4) More electropositive substituents prefer hybrid orbitals having less S character
(A) 1 and 2 are correct (B) 2 and 3 are correct
(C) 3 and 4 are correct (D) 1 and 4 are correct

(AP-SET 2014)

38. The correct order of the solubility of the following in water is
(A) $BeSO_4 < MgSO_4 < CaSO_4 < SrSO_4$
(B) $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4$
(C) $BeSO_4 < MgSO_4 \sim CaSO_4 < SrSO_4$
(D) $BeSO_4 > MgSO_4 \sim CaSO_4 < SrSO_4$

(AP-SET 2014)

39. The correct statements among the following are:
(1) Angular momenta of 1s, 2s and 3s orbitals are same
(2) Energies of 1s, 2s and 3s orbitals are same
(3) Angular momenta of 1s, 2s and 3sorbitals are different
(4) Energies of 1s, 2s and 3s orbitals are different
(A) 1, 2 (B) 2, 3
(C) 3, 4 (D) 1, 4

(AP-SET 2014)

40. Assertion (A): The bond angle in NF_3 is less than that in NH_3.
Reason (R): The high electronegativity of F pulls the bonding electrons in NF_3 further away from N and a greater distortion is caused.
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

(AP-SET 2014)

41. Assertion (A): The radius of Fe^{3+} is less than that of Fe^{2+}.
Reason (R): Fe^{3+} has a lower effective nuclear charge than Fe^{2+}.
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

(AP-SET 2018)

42. Arrange in order of increasing dipole moment BF_3, H_2S, H_2O
(A) $BF_3 < H_2S < H_2O$ (B) $H_2S < H_2O < BF_3$
(C) $H_2S < BF_3 < H_2O$ (D) $H_2O < H_2S < BF_3$

(AP-SET 2018)

43. The number of peroxide bonds in perxenate ion, $[XeO_6]^{4-}$ is:
(A) 0 (B) 2
(C) 3 (D) 1

JAMMU KASHMIR SET

(J&K -SET 2011)

44. Which of the following is the largest in size?
(A) Cl^- (B) S^{2-}
(C) Na^+ (D) F^-

(J&K -SET 2011)

45. The hybridization involved in PCl_5 is:
(A) sp^3d (B) sp^3d^2
(C) d^2sp^2 (D) sp^3

(J&K -SET 2011)

46. Among the following which one is a linear molecule having zero dipole moment?
(A) H_2O (B) HCl
(C) CO_2 (D) H_2S

(J&K -SET 2011)

47. Among the following, the compound that is readily soluble in water is:
(A) $BeSO_4$ (B) $CaSO_4$
(C) $SrSO_4$ (D) $BaSO_4$

(J&K -SET 2012)

48. The hybridization of Carbon in molecular CO_2 is:
(A) sp (B) sp^2
(C) sp^3 (D) sp^3d

(J&K -SET 2018)

49. The correct order of the solubility of the following in water is
(A) $BeSO_4 < MgSO_4 < CaSO_4 < SrSO_4$
(B) $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4$
(C) $BeSO_4 < MgSO_4 = CaSO_4 < SrSO_4$
(D) $BeSO_4 > MgSO_4 = CaSO_4 < SrSO_4$

(J & K-SET 2018)

50. Assertion (A): The bond angle in NF_3 is less than that in NH_3.
Reason (R): The high electronegativity of F pulls the bonding electrons in NF_3 further away from N and a greater distortion is caused.
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

KL SET

(KL-SET 2012)

51. …… does not exist
(A) ClF_3 (B) BrF_3
(C) IF_3 (D) ICl_2

(KL-SET 2012)

52. The angle between the three iodine atoms of I_3^- ion is…….
(A) 60^0 (B) 90^0
(C) 120^0 (D) 180^0

(KL-SET 2013)

53. Which of the following pentafluoride does not exist?
(A) NF_5 (B) AsF_5
(C) SbF_5 (D) AsF_5

(KL -SET 2013)

54. Valinomycin is an ionophore that specially binds with
(A) Na^+ ion (B) K^+ ion
(C) Na^+ and K^+ ion (D) Any alkali metal ion

(KL-SET JUNE 2017)

55. The type of molecular interactions in liquid nitrogen is:
(A) Dipole – dipole
(B) Dipole -induced dipole
(C) Ion- dipole
(D) Induced dipole – induced dipole

RAJ SET

(RAJ-SET 2013)

56. Which is the most soluble in water amongst the following?
(A) LiF (B) LiCl
(C) LiBr (D) LiI

WB SET

(WB-SET)

57. NaOH and HOCl both contains – OH groups but the former is base while the latter is acid in their aqueous solution, because
(A) Na-O bond is more polar than O-H bond in NaOH
(B) –O-H bond is more polar than Na-O bond in NaOH
(C) H-O bond in HOCl is less polar
(D) –O-Cl bond in HOCl is more polar

(WB SET 2017)

58. The structures of NF_3 and NH_3 are based on a tetrahedron with one corner occupied by a lone pair. Which one of the statements is true for both the molecules?
(A) both are pyramidal with bond angles 107.5
(B) both are pyramidal with bond angles 102.3 and 107.5 respectively.
(C) both are pyramidal with bond angles 109.5
(D) both are pyramidal with bond angles 105 and 107.5 respectively.

(WB SET 2015)

59. The hybrid state of carbon in C-60
(A) sp (B) sp^2
(C) sp^3 (D) dsp^2

(WB-SET 2015)

60. The number of pairs of framework electrons in the closo borane $[B_nH_n]^{2-}$
(A) n+1 (B) n+2
(C) n+3 (D) n+4

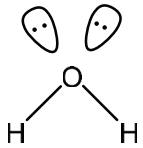
ANSWER KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	B	D	C	D	B	C	B	B	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
C	C	C	D	A	A	C	B	D	C
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
B	C	A	A	C	D	B	D	C	C
31	**32**	**33**	**34**	**35**	**36**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

:: SOLUTIONS ::

MH SET

1. **Solution: (A)**

Hybridization of central atom Oxygen in H_2O molecules is sp^3 with tetrahedral geometry with two lone pair of electrons and two bond pairs. lone pair – lone pair repulsion is more as compare to bond-pair-bond pair repulsion in a molecule creating deviation in bong angle from $109.5°$ to $104.5°$.



Therefore, Option (A) is correct.

2. **Solution: (B)**

Solubility of compound depend on lattice energy and Hydration energy. decreasing lattice energy favours increasing solubility. AS CaF_2 molecule has extremely high lattice energy. Hence it is insoluble in water.

Therefore, Option (B) is correct.

3. **Solution: (D)**

Electronegativity of central atom decrease, bond angle decrease. As we move down the group electronegativity of atom decreases in order of $N > P >$ As in periodic table. Hence increasing order of bond angle in H-A-H molecule is in order $NH_3 > PH_3 > A_sH_3$

Therefore, Option (D) is correct.

4. **Solution: (C)**

If central atom is more electronegative than surrounding atoms then it attracts more negative charge toward itself. In comparison with Boron and Hydrogen, electronegativity of H is 2.1 while that of B is 1.5. Therefore, Hydrogen carries negative charge in B-H bond. In case of F-H, O-H and N-H. Electronegativity of F, O and N is more as compare to H atom resp.

Therefore, Option (C) is correct.

5. **Solution: (D)**

In LiF, Fluoride ion have small size and lattice energy of LiF is higher than its hydration energy, therefore it is insoluble in water or other hands In LiI size of Iodide ion is much more larger than fluoride ion. Hence its lattice energy comparatively lower than LiF, therefore LiI is more soluble than LiF.

Therefore, Option (D) is correct.

GUJARAT SET

6. **Solution: (B)**

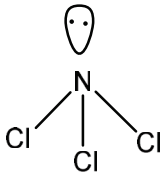
In $N(SiH_3)_3$, silicon atom have vacant d-orbital. Therefore, lone pair of nitrogen is resonating with the empty d orbital of silicon causing planar structure of $N(SiH_3)_3$ molecule and this lone pair on nitrogen is not available for donation resulting least basicity. In $N(CH_3)_3$ electron donating inductive effect $(+I)$ of CH_3 make Nitrogen atom more electron rich to donate lone pair and passes highest basicity among all.

Therefore, Option (B) is correct.

7. **Solution: (C)**

In Nitrogen trichbride (NCl_3) blybridization of nitrogen atom is sp^3 which posseses tetrahedral geometry with one long pair and three bond pairs. As long pair-bond pair

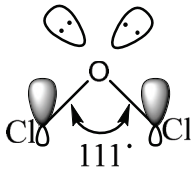
repulsion is more stronger as compare to bond pair-bond pair repulsion. Hence it decrease bond angle from $109.5°$ to $107.5°$



Therefore, Option (C) is correct.

8. **Solution: (B)**

Geometry of Cl_2O molecule is Tetrahdral as same as H_2O but two chlorine atoms are much larger in size than hydrogen atom which creates steric Hindrance and bond angle increase to $111°$.



Therefore, Option (B) is correct.

9. **Solution: (B)**

Polarizing power of charged species depend on charge-to-size ratio of ions. As charge to size ratio increases then polarizing power of ions also increases. In case of Ca^{+2}, Mg^{+2} and Be^{+2}. Charge is same but order of size is given as $Ca^{+2} > Mg^{+2} > Be^{+2}$. Therefore, increasing order of Charge to size ratio (charge density) is in order of $Be^{+2} > Mg^{+2} > Ca^{+2}$ and polarizing power also in order of $Be^{+2} > Mg^{+2} > Ca^{+2}$. Charge on K^+ is lowest and size is larger which give lowest charge density and polarizing power.

Therefore, Option (B) is correct.

10. **Solution: (C)**

According to molecular orbital theory (MOT), total numbers of electron in diatomic molecule and bond order relation given in following table,

Total No. of Electrons	8	9	10	11	12	13	14
Bond Order	0	0.5	1	1.5	2	2.5	3
Total No. of Electrons	15	16	17	18	19	20	
Bond Order	2.5	2	1.5	1	0.5	0	

Total no. of electrons in N_2 molecule = $7 + 7 = 14$, bond order $= 3$

Total no. of electrons in O_2 molecule = $8 + 8 = 16$, bond order $= 2$

Total no. of electrons in O_2^- molecule = $8 + 8 + 1 = 17$, bond order $= 1.5$

Total no. of electrons in O_2^+ molecule = $8 + 8 - 1 = 15$, bond order $= 2.5$

Total no. of electrons in NO molecule = $7 + 8 = 15$, bond order $= 2.5$

Hence, $NO \ and \ O_2^+$ molecule have identical bond orders

Therefore, Option (D) is correct.

11. **Solution: (C)**

Orbitals involve in dsp^2 hybridisation are, $dx^2 - y^2, s, p_x \ and \ p_y$.

Therefore, Option (C) is correct.

12. **Solution: (C)**

Oxidation state of central atom increases Acidity also increases.

Less oxidation state of central atom basicity increases

CrO	CrO_3
+2	+6
More basic	more acidic.

Therefore, Option (C) is correct.

13. **Solution: (C)**

If size increases hydration energy decreases

$\therefore$ small size has more hydration energy

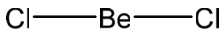
$\therefore Li > Na > K > Rb$

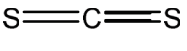
Therefore, Option (C) is correct.

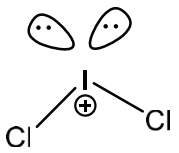
HP SET

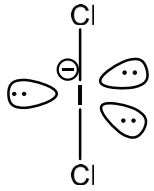
14. **Solution: (D)**

Hybridization of ICl_2^+ is sp^3 and passes tetrahedral geometry i.e. Bent shape, which is not linear. In case of $BeCl_2$ and CS_2 Hybridization is sp & having linear geometry while in ICl_2^- Hybridization is sp^3d and passes trigonal bipyramidal geometry i.e. linear shape.









Therefore, Option (D) is correct.

15. **Solution: (A)**

Hybridization of atomic orbitals of N in NO_2^+, NO_3^- and NH_4^+ are

NO_2^+: Number of lone pair = 0 and Number of Bond pair = 2

Total Electron pairs = 2

Hybridization of NO_2^+ is sp

NO_3^- : Number of lone pair = 0 and Number of Bond pairs = 3

Total electron pairs = 3

Hybridization of NO_3^- is Sp^2

NH_4^+ : Number of Bond pairs = 4 and Number of lone pairs = 0

Total number of electron pairs = 4

Hybridization of NH_4^+ is sp^3

Therefore, Option (A) is correct.

16. **Solution: (A)**

Strength of Covalent bond depend on strenght of overlap between atomic orbitals. greater the overlap between atomic orbitals, more stable the bond. s-s orbital overlap is stronger as it is linear overlap of orbital of same kind. While P-P orbital overlap is weaker it is lateral overlap between p- orbitals. s-p overlap of orbital is of two different orbital overlap in linear fashion, Hence it weaker as campare to s-s overlap and stronger as campare to P-P overlap.

Therefore, Option (A) is correct.

17. **Solution: (C)**

In He_2 molecular orbital diagram contains two electron in σ_{1s} bonding MO and two electron in σ_{1s}^* antibonding MO. So, its bond order calculated from formula,

$$\text{Bond order} = \frac{\text{No.of e in } \sigma_{1s} - \text{No.of in } \sigma_{1s}^*}{2} = \frac{2-2}{2} = 0$$

Molecule with bond order zero does not exist. Hence He_2 molecule is not stable

Therefore, Option (C) is correct.

18. **Solution: (B)**

Volatility of compound is ability of compound to change into gaseous phases. Ionic compound have strong bonds & they readily don't changes to gaseous phase, but covalent compound have weak attractive forces and easily converted to gaseous phase.

Water is polar compound. As per concept of like dissolve in like. Non-polar covalent compound not dissolve in polar water.

Therefore, Option (B) is correct.

19. **Solution: (D)**

The bonding between $NH_3 - BF_3$ is coordinate (dative) bonding. Which are just interactions between lone pair of Nitrogen of NH_3 and vacant orbital of Boron in BF_3. These weak interactions make both NH_3 and BF_3 to remain in their independent existence.

Therefore, Option (D) is correct.

20. **Solution: (C)**

Hybridization atom calculated from sum of lone pair and bond pairs. In AlF_4^- molecule.

Number of lone pairs = 0

Number of Bond pairs = 4

Total electron pairs = 4

As AlF_4^- molecule has total four electron pairs, it posses sp^3 Hybridization.

Therefore, Option (C) is correct

21. **Solution: (B)**

(A) $[Ar]\ 4S^2, 3d^{10}, 4P^6\ 5S^1 = Rb\ (Rubidium)$

(B) $1S^2, 2S^1, 2P^1 = B\ (Boron)$

(C) $1S^2, 2S^2, 2P^1 = Be(Beryllium)$

(D) $[Ar]\ 4S^1, 4P^1 = Ca\ (Calcium)$

Therefore, Option (B) is correct.

22. **Solution: (C)**

$Al + NaOH \rightarrow NaAlO_2 + H_2$

$Zn + NaOH \rightarrow Na_2ZnO_2 + H_2$

$Mg + 2NaOH \rightarrow Mg(OH)_2 + 2Na$

$LiH + H_2O \rightarrow LiOH + H_2$

Only in the reaction of Mg with NaOH not production H_2 gas. Therefore, Option (C) is correct.

23. **Solution: (A)**

BF_3 is planar molecular with trigonal planar geometry and overall dipole moment of BF_3 is zero. In comparison of H_2O and H_2S, H_2O has more dipole moment as electronegativity difference between oxygen and hydrogen is more as campare to hydrogen and Sulphur. Overall order of dipole moment is $H_2O > H_2S > BF_3$

Therefore, Option (A) is correct.

KARNATAKA SET

24. **Solution: (A)**

Phosphoric acid (H_3PO_4) has total 50 electrons out of which 15 electrons from phosphorus, 8 electrons from each of four oxygen atom and one electron from each of three hydrogen atoms.

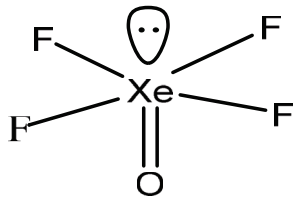
Therefore, Option (A) is correct.

25. **Solution: (C)**

Hybridization of $XeOF_4$ is Sp^3d^2 and geometry is octahedral.

Principle axis is C_4 where subsidiary axis is absent. Also vertical plane σ_v present

Therefore, point group is C_{4v}.



Therefore, Option (C) is correct.

26. **Solution: (D)**

Hybridization of PF_5 is SP^3d and geometry is trigonal bipyramidal. At room temperature PF_5 show fluctuatinal behavior and all Fluorine show only one signal. with $(2nI+1) = 2\times1\times1/2+1 = 2$ (doublet) as I value for P is ½.

Therefore, Option (D) is correct.

27. **Solution: (B)**

Hybridization of Be in BeH_2 is sp which show linear geometry and O in H_2O is Sp^3 which show tetrahedral geometry (bend shape). Hence both Assertion and reason are correct and R is correct explanation of A.

Therefore, Option (B) is correct.

28. **Solution: (D)**

Geometry of SO_3 Trigonal planar and Hybridization sp^2

Geometry of NO_3^- Trigonal planar and Hybridization sp^2

Geometry of CO_3^{-2} Trigonal planar and Hybridization sp^2

Geometry of SO_3^{-2} Tetrahedral and Hybridization sp^3

Only SO_3^{-2} is non-planar species among all.

Therefore, Option (D) is correct.

29. **Solution: (C)**

Fluorinating agent are the substances, where reaction active species are electron deficient species. XeF_6 is strongest fluorinating agent among all.

Therefore, Option (C) is correct.

30. **Solution: (C)**

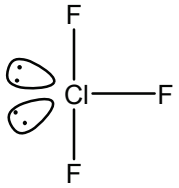
Hydrolysis reaction of XeF_6,

$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$

Therefore, Option (C) is correct.

31. **Solution: (A)**

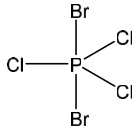
Hybridization of ClF_3 is Sp^3d and geometry is trigonal bipyramidal (shape is T-shaped). As ClF_3 have rigid structure, so it have 2 types of fluorines (axial and equatorial). So $^{19}F\ NMR$ signal show two peak one is due to of equatorial fluorine which show $(2nI+1) = \left[2\times1\times\frac{1}{2}\right]+1 = 2$ (doublet) and other peak due to of two axial fluorine which show $(2nI+1) = [2\times1\times\frac{1}{2}]+1 = 3$ (triplet).



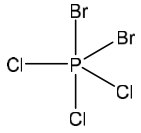
Therefore, Option (A) is correct.

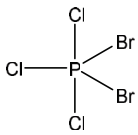
32. **Solution: (A)**

PBr_2Cl_3 posseses total three isomer out of which only one isomer have zero dipole moment while other two have non-zero dipole moments as follows,



Dipole moment is zero.





Molecules with Non-zero Dipole moment

Therefore, Option (A) is correct.

33. **Solution: (B)**

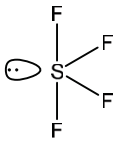
Electrical conductivity of molten iodine solution is because of self-ionization equilibrium reaction,

$3I_2 \rightleftharpoons I_3^+ + I_3^-$

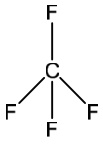
Therefore, Option (B) is correct.

34. **Solution: (A)**

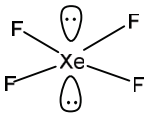
Geometry SF_4, CF_4 and XeF_4 are



Lone pair = 1



Lone pair = 0



Lone pair = 2

Therefore, Option (A) is correct.

AP SET

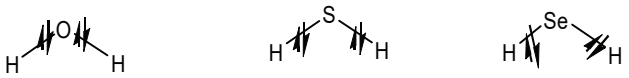
35. **Solution: (A)**

Stability of compound depend on effective interaction between atoms bounded together. In LiF, Lithium and Fluorine has approximately same size and strong interaction present in between them make LiF most stable. In LiI Iodine is larger in size as compare to Lithium and weak interaction between them to form LiI molecule. same phenomenon observed in case of HgF_2 and BeI_2

Therefore, Option (A) is correct.

36. **Solution: (D)**

Bond angle of molecule depend on electronegativity of central atom. As central atom is more electronegative it pull share pair of electron towards itself in bonds. these electron pair repell each other and increase bond angle.



Therefore, Option (D) is correct.

37. **Solution: (B)**

According to Bent's rule more electronegative substituent prefer hybrid orbital having less s - character and more electropositive substituents prefer hybrid orbital having more s - character.

Therefore, Option (B) is correct.

38. **Solution: (B)**

In case of sulphates of alkaline earth metal, size of compound almost same as sulphate ion are already large in size as compare to metal cation and small increase in size of metal cation does not affect overall size of compound. Hydration enthalpy decrease down the group as size of cation increase. Hence solubility of sulphates decreases down the group from Be^{+2} to Sr^{+2}.

Therefore, Option (B) is correct.

39. **Solution: (D)**

As value of angular quantum number (l) is same for each s-orbital, hence angular momentum of 1s, 2s and 3s orbital are same. While energy of 1s, 2s and 3s orbital are arranged in increasing order as follows $3s > 2s > 1s$

Therefore, Option (D) is correct.

40. **Solution: (A)**

Bond angle of F-N-F in NF_3 is $102.5°$ and H-N-H in NH_3 $107.8°$. Therefore, bond angle of NF_3 is less than NH_3, this is due to high electronegativity of F pulls bonding electrons away from N and bond pair-bond pair repulsion decreases. And greater distortion in bond angle is caused. Hence Both Assertion (A) and Reason (R) are correct and R is correct explanation of A.

Therefore, Option (A) is correct.

41. **Solution: (C)**

Radius of Fe^{+3} is less than that of Fe^{+2}. As one more electron remove from Fe^{+2} to form Fe^{+3} which result larger nuclear charge on remaining electrons. This cause outer shell of Fe^{+3} to be pulled little more inward campare to Fe^{+2}. Hence its size smaller. Therefore Assertion (A) is true but Reason (R) is false.

Therefore, Option (C) is correct.

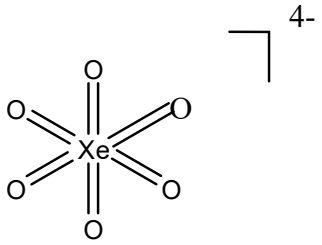
42. **Solution: (A)**

BF_3 is planar molecular with trigonal planar geometry and overall dipole moment of BF_3 is zero. In comparison of H_2O and H_2S, H_2O has more dipole moment as electronegativity difference between oxygen and hydrogen is more as campare to hydrogen and Sulphur. Overall order of dipole moment is $H_2O > H_2S > BF_3$

Therefore, Option (A) is correct.

43. **Solution: (A)**

Hybridization of $[XeO_6]^{-4}$ is Sp^3d^2 and have octahedral geometry with no presence of peroxobond



Therefore, Option (A) is correct.

JAMMU KASHMIR SET

44. **Solution: (B)**

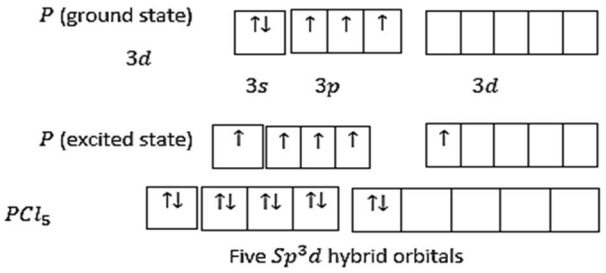
More the negative charge on an atom, more the inter electronic repulsion and ion have maximum size, similarly positive charge on ion increase effective nuclear charge hence size of ion decreases. Overall order of size is $S^{-2} > Cl^- > F^- > Na^+$

Therefore, Option (B) is correct.

45. **Solution: (B)**

Electronic configuration of phosphorus is

$P = [Ne]\, 3S^2, 3P^3$



$\therefore$ Hybridization of PCl_5 is Sp^3d

Therefore, Option (A) is correct.

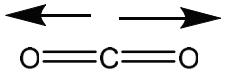
46. **Solution: (C)**

(i) H_2O is bend molecular and it is polar

(ii) HCl is polar molecule as chlorine is more electronegative than hydrogen and possesses non-zero dipole moment.

(iii) Similar to H_2O, H_2S is bend molecule and possess non-zero dipole moment.

(iv) CO_2 is linear molecule but having zero dipole moment as both dipoles are equal and opposite indirection.



Therefore, Option (C) is correct.

47. **Solution: (A)**

Solubility of sulphates of alkaline earth metals in water decrease on moving down the group as size of metal cation decreases and Hydration energy increases which result in decrease in solubility of metal sulphates. Overall order of solubility is

$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

Therefore, Option (A) is correct.

48. **Solution: (A)**

In CO_2 molecule,

Number of lone pair on central $C = 0$

Number of bond pairs on central $C = 2$

Hybridization of CO_2 is Sp

Therefore, Option (A) is correct.

49. **Solution: (B)**

Solubility of sulphates of alkaline earth metals in water decrease on moving down the group as size of metal cation increases and Hydration energy decreases which result in decrease in solubility of metal sulphates. Overall order of solubility is

$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

Therefore, Option (B) is correct.

50. **Solution: (A)**

Bond angle of F-N-F in NF_3 is $102.5°$ and H-N-H in NH_3 $107.8°$. Bond angle of NF_3 is less than NH_3, this is due to high electronegativity of F, F pulls bonding electrons away from N hence less bond pair-bond pair repulsion takes place. Hence in NF_3 lesser bond angle than NH3. Hence Both Assertion (A) and Reason (R) are correct and R is correct explanation of A.

Therefore, Option (A) is correct.

KL SET

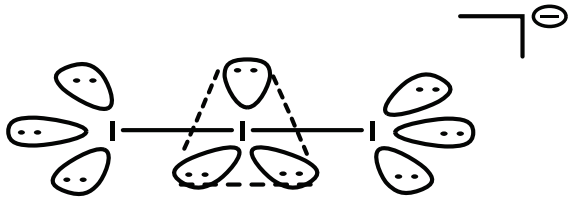
51. **Solution: (D)**

Interhalogen compound in the form of AB_2, AB_4 does not exist, only AB, AB_3, AB_5, AB_7 exist. In AB_2 type of compound only one unpaired e^- left after Hybridization & bonding which is not possible in real case. Hence ICl_2 does not exist.

Therefore, Option (D) is correct.

52. **Solution: (D)**

Geometry of I_3^- is Trigonal bipyramidal and posses Sp^3d Hybridization But shape of I_3^- is linear and having $180°$



Therefore, Option (D) is correct.

53. **Solution: (A)**

In case of Nitrogen due to absence of empty d-orbital it cannot expand it valency up to 5 and not form penta-coordinated compounds. Hence NF_5 does not exist.

Therefore, Option (A) is correct.

54. **Solution: (B)**

Valinomycin is naturally occurring lipid molecule that bind with K^+ ions and facilitate transfer of it across lipid bilayer which is act as ionosphere.

Therefore, Option (B) is correct.

55. **Solution: (B)**

In liquid Nitrogen gas partial charges formed within one molecule of $N_{2,}$, inducing partial charge on nearby molecule and all molecule around it show behavior like polar molecule which hold all molecule together by weak forces called Dipole-Induced dipole interaction.

Therefore, Option (B) is correct.

RAJ SET

56. **Solution: (A)**

It lithium halides, order of increasing size given as $LiI > LiBr > LiCl > LiF$. As size of compound increases Hydration energy decreases which result in decreasing solubility, therefore LiF having smallest size and high solubility in water.

Therefore, Option (A) is correct.

WB SET

57. **Solution: (A)**

In $NaOH$, $\mathrm{Na} - \mathrm{O}$ bond is more polar as compare to $O - H$ bond and it easily dissociates as Na^+ and OH which act as base. But in $HOCl$, $H - OCl$ bond is more polar than $O - Cl$ bond and it dissociates as H^+ and OCl which act as acid.

Therefore, Option (A) is correct.