CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

CHEMISTRY

Single Correct Answer Type

1. Born Haber cycle is used to determine:
   a) Lattice energy b) Electron affinity c) Ionization energy d) Either of them
2. The electronic configurations of four elements L, P, Q and R are given below,
   $L = 1s^2, 2s^2 2p^4 \quad Q = 1s^2, 2s^2 2p^6, 3s^2 3p^5$
   $P = 1s^2, 2s^2 2p^6, 3s^1 \quad R = 1s^2, 2s^2 2p^6, 3s^2$
   The formula of the ionic compounds that can be formed between these elements are:
   a) L_2P, RL, PQ, R_2Q b) LP, RL, PQ, RQ c) P_2L, RL, PQ, RQ_2 d) LP, R_2L, P_2Q, RQ
3. The element with strong electropositive nature is:
   a) Cu b) Cs c) Cr d) Ba
4. Octet rule is not valid for the molecule:
   a) CO_2 b) H_2O c) O_2 d) CO
5. The correct order of reactivity of halogens is
   a) F > Br > Cl > I b) F > Cl > Br > I c) I > Br > Cl > F d) Cl > I > Br > F
6. NH_3 has higher boiling point than expected, because :
   a) With water it forms NH_4OH
   b) It has strong intermolecular hydrogen bonds
   c) It has strong intermolecular covalent bonds
   d) Its density decreases in freezing
7. The screening effect of d-electrons is:
   a) Equal to the p-electrons
   b) Much more than p-elecrons
   c) Same as f-electrons
   d) Less than p-electrons
8. Which has the largest first ionisation energy?
   a) Li b) Na c) K d) Rb
9. In which of the following molecules are all the bonds not equal?
   a) AlF_3 b) NF_3 c) ClF_3 d) BF_3
10. The bond between two identical non-metal atoms has a pair of electrons:
    a) Unequally shared between the two
    b) Equally shared between the two
    c) Transferred fully from one atom to another
    d) None of the above
11. The number of unpaired electrons in a paramagnetic diatomic molecule of an element with atomic number 16 is:
    a) 4 b) 1 c) 2 d) 3
12. In NO_3^- ion, number of bond pair and lone pair electrons are respectively:
    a) 2, 2 b) 3, 1 c) 1, 3 d) 4, 8
13. Which element of second period forms most acidic oxide?
    a) Carbon b) Nitrogen c) Boron d) Fluorine
14. The electronic configuration of four elements are given below. Which element does not belong to the same family?
    a) $[Xe]4f^{14}5d^{10}6s^2$ b) $[Kr]\ 4d^{10}5s^2$ c) $[Ne]3s^2 3p^5$ d) $[Ar]\ 3d^{10}4s^2$

15. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order?
(At. no. Cr = 24, Mn = 25, Fe = 26, Co = 27)
a) Cr > Mn > Co > Fe b) Mn > Fe > Cr > Co c) Fe > Mn > Co > Cr d) Co > Mn > Fe > Cr
16. Which is correct in the following?
a) Radius of Cl atom is 0.99 Å, while that of Cl^+ ion is 1.54 Å
b) Radius of Cl atom is 0.99 Å, while that of Na atom is 1.54 Å
c) The radius of Cl atom is 0.95 Å, while that of Cl^- ion is 0.81 Å
d) Radius of Na atom is 0.95 Å, while that of Na^+ ion is 1.54 Å
17. The linear structure is possessed by:
a) $SnCl_2$ b) NCO^- c) NO_2^+ d) CS_2
18. Which of the following has largest ionic radius?
a) Na^+ b) K^+ c) Li^+ d) Cs^+
19. In the cyanide ion, the formal negative charge is on:
a) C
b) N
c) Both C and N
d) Resonate between C and N
20. The size of ionic species is correctly given in the order:
a) $Cl^{7+} > Si^{4+} > Mg^{2+} > Na^+$
b) $Na^+ > Mg^{2+} > Si^{4+} > Cl^{7+}$
c) $Na^+ > Mg^{2+} > Cl^{7+} > Si^{4+}$
d) $Cl^{7+} > Na^+ > Mg^{2+} > Si^{4+}$
21. Which statement is wrong?
a) 2nd ionisation energy shows jump in alkali metals
b) 2nd electron affinity for halogens is zero
c) Maximum electron affinity exists for F
d) Maximum ionization energy exists for He
22. Which of the following atoms has minimum covalent radius?
a) Si b) N c) C d) B
23. The second electron affinity is zero for
a) Alkali metals b) Halogens c) Noble gases d) Transition metal
24. For alkali metals, which one of the following trends is incorrect?
a) Hydration energy : Li > Na > K > Rb b) Ionisation energy : Li > Na > K > Rb
c) Density : Li < Na < K < Rb d) Atomic size : Li < Na < K < Rb
25. Na_2O, MgO, Al_2O_3 and SiO_2 have heat of formation equal to −416, −602, −1676 and −911 kJ mol^{-1} respectively. The most stable oxide is
a) Na_2O b) MgO c) Al_2O_3 d) SiO_2
26. If Aufbau rule is not followed, K-19 will be placed in
a) s-block b) p-block c) d-block d) f-block
27. The electronegativity order of O, F, Cl and Br is:
a) F > O > Cl > Br b) F > Cl < Br > O c) Br > Cl > F > O d) F < Cl < Br < O
28. Which has the minimum bond energy?
a) H − Br b) H − I c) I − I d) H − H
29. The bond angle in H_2S (for H − S − H) is:
a) Same as that of Cl − Be − Cl in $BeCl_2$
b) Greater than H − N − H bond angle in NH_3
c) Greater than H − Se − H and less than H − O − H
d) Same as Cl − Sn − Cl in $SnCl_2$
30. In which of the following arrangements, the sequence is not strictly according to the property written

against it?

a) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

b) $HF < HCl < HBr < HI$: increasing acid strength

c) $NH_3 > PH_3 < AsH_3 < SbH_3$: increasing basic strength

d) $B < C < O < N$: increasing first ionisation enthalpy

31. The tenth elements in the Periodic Table resembles with the

a) First period b) Second period c) Fourth period d) Ninth period

32. Which is not the correct order for the stated property?

a) $Ba > Sr > Mg$; atomic radius b) $F > O > N$; first ionisation enthalpy

c) $Cl > F > I$; electron affinity d) $O > Se > Te$; electronegativity

33. The unequal sharing of bonded pair of electrons between two atoms in a molecule gives rise to:

a) Ionic bond

b) Polar covalent bond

c) Non-polar covalent bond

d) None of the above

34. Which of the following oxides is most acidic in nature?

a) BeO b) MgO c) CaO d) BaO

35. In the formation of NaCl by combination of Na and Cl:

a) Sodium and chlorine both lose electrons

b) Sodium and chlorine both gain electrons

c) Sodium loses but chlorine gains electrons

d) Sodium gains but chlorine loses electrons

36. The molecule having three folds of axis of symmetry is:

a) NH_3 b) PCl_5 c) SO_2 d) CO_2

37. The covalent compound HCl has the polar character because:

a) The electronegativity of hydrogen is greater than that of chlorine

b) The electronegativity of hydrogen is equal to than that of chlorine

c) The electronegativity of chlorine is greater than that of hydrogen

d) Hydrogen and chlorine are gases

38. If the bond has zero percent ionic character, the bond is:

a) Pure covalent b) Partial covalent c) Partial ionic d) Coordinate covalent

39. In piperidine  H,N atom has hybridization:

a) sp b) sp^2 c) sp^3 d) dsp^2

40. Mendeleef's Periodic Table is upset by the fact that

a) Many elements has several isotopes b) Noble gases do not form compounds

c) Some groups stand divided into two sub groups A and B d) Atomic weights of elements are not always whole numbers

41. The incorrect statement among the following is:

a) The first ionization potential of Al is less than the first ionization potential of Mg

b) The second ionization potential of Mg is greater than the second ionization potential of Na

c) The first ionization potential of Na is less than the first ionization potential of Mg

d) The third ionization potential of Mg is greater than the third ionization potential of Al

42. Which one of the following is an amphoteric oxide?

a) ZnO b) Na_2O c) SO_2 d) B_2O_3

43. The shape of ClO_4^- ion is:

a) Square planar b) Square pyramidal c) Tetrahedral d) Trigonal bipyramidal

44. Which one is correct?

a) Dinitrogen is paramagnetic

b) Dihydrogen is paramagnetic

c) Dioxygen is paramagnetic
d) Dioxygen is diamagnetic

45. In which one of the following pairs the radius of the second species is greater than that of the first?
a) Na, Mg b) O^{2-}, N^{3-} c) Li^{+}, Be^{2+} d) Ba^{2+}, Sr^{2+}

46. Atomic radii of fluorine and neon in angstrom unit are respectively given by:
a) 0.72, 1.60 b) 1.60, 1.60 c) 0.72, 0.72 d) 1.60, 0.72

47. According to IUPAC nomenclature, a newly discovered element has been named as Uun. The atomic number of the element is
a) 111 b) 112 c) 109 d) 110

48. The correct order of increasing electron affinity of halogens is
a) $F < Cl < Br < I$ b) $I < Br < F < Cl$ c) $I > Br > Cl > F$ d) $Br > I > F > Cl$

49. Al element X has 3 electrons in p-orbitals and also belongs to III period. Its molecular formula should be:
a) X b) X_2 c) X_4 d) X_5

50. Which of the following sequence regarding ionisation potential of coinage metal is correct:
a) Cu > Ag > Au b) Cu < Ag < Au c) Cu > Ag < Au d) Ag > Cu < Au

51. The bond length is maximum in:
a) H_2S b) HF c) H_2O d) Ice

52. Which of the following is the most electropositive element?
a) P b) S c) Mg d) Al

53. Which group of atoms have nearly same atomic radius?
a) Na, K, Rb, Cs b) Li, Be, B, C c) Fe, Co, Ni, Cu d) F, Cl, Br, I

54. Which of the following statements is wrong?
a) Metals are more than non-metals.
b) There are only few metalloids.
c) Hydrogen can be placed with alkali metals as well as with halogen in Periodic Table.
d) Non-metals are more than metals.

55. Which one of the following has the lowest ionisation energy?
a) $1s^2 2s^2 2p^6$ b) $1s^2 2s^2 2p^6 3s^1$ c) $1s^2 2s^2 2p^5$ d) $1s^2 2s^2 2p^3$

56. The set representing the correct order of first ionisation potential is:
a) K > Na > Li b) Be > Mg > Ca c) B > C > N d) Ge > Si > C

57. Which one of the following belongs to representative group of elements in the Periodic Table?
a) Aluminium b) Chromium c) Argon d) Lanthanum

58. The shape of NO_3^- is planar. It is formed by the overlapping of oxygen orbitals with … orbitals of nitrogen .
a) sp^3-hybridized b) sp^2-hybridized c) Three p-orbitals d) None of these

59. If a molecule MX_3 has zero dipole moment the sigma bonding orbitals used by M(at. no. < 21) is:
a) Pure p b) sp-hybrid c) sp^2-hybrid d) sp^3-hybrid

60. 1, 3-butadiene has:
a) 6σ and 2π-bonds b) 2σ and 2π-bonds c) 9σ and 2π-bonds d) 6σ and 2π-bonds

61. Which of the following transitions involves maximum amount of energy?
a) $M^-(g) \rightarrow M(g)$ b) $M(g) \rightarrow M^+(g)$ c) $M^+(g) \rightarrow M^{2+}(g)$ d) $M^{2+}(g) \rightarrow M^{3+}(g)$

62. Which of the following molecular species has unpaired electron(s)?
a) N_2 b) F_2 c) O_2^- d) O_2^{2-}

63. The element having lowest ionisation energy among the following is:
a) $1s^2, 2s^2 2p^3$ b) $1s^2, 2s^2 2p^6, 3s^1$ c) $1s^2, 2s^2 2p^6$ d) $1s^2, 2s^2 2p^5$

64. Which of the following has largest ionic radius?
a) Li^+ b) K^+ c) Na^+ d) Cs^+

65. Which will not conduct electricity?
a) Aqueous KOH solution
b) Fused NaCl
c) Graphite

d) KCl in solid state

66. The bond order is maximum in:
    a) H_2 b) H_2^+ c) He_2 d) He_2^+
67. The isoelectronic species among the following are:
    $I - CH_3^+; II - NH_2^+; III - NH_4^+; IV - NH_3$
    a) I, II, III b) II, III, IV c) I, II, IV d) II, I
68. The screening effect of d-electros is
    a) Equal to that of p-electrons b) More than that of p-electrons
    c) Same as f-electrons d) Less than p-electrons
69. OF_2 is:
    a) Linear molecule and sp-hybridized
    b) Tetrahedral molecule and sp^3-hybridized
    c) Bent molecule and sp^3-hybridized
    d) None of the above
70. Be and Al exhibit diagonal relationship. Which of the following statement about them is/are not true?
    I. Both react with HCl to liberate H_2
    II. They are made passive by HNO_3
    III. Their carbides given acetylene on treatment with water
    IV. Their oxides are amphoteric
    a) (iii) and (iv) b) (i) and (iii) c) (i) only d) (iii) only
71. Which is not linear?
    a) CO_2 b) HCN c) C_2H_2 d) H_2O
72. In which of the following bond angle is maximum?
    a) NH_3 b) NH_4^+ c) PCl_5 d) SCl_2
73. The molecule which has pyramidal shape is:
    a) PCl_3 b) SO_3 c) CO_3^{2-} d) NO_3^-
74. The complex ion which has no $'d'$ electrons in the central metal atom is:
    a) $[MnO_4]^-$ b) $[Co(NH_3)_6]^{3+}$ c) $[Fe(CN)_6]^{3-}$ d) $[Cr(H_2O)_6]^{3+}$
75. For the formation of covalent bond, the difference in the value of electronegativities should be:
    a) Equal to or less than 1.7
    b) More than 1.7
    c) 1.7 or more
    d) None of the above
76. Strongest bond is in:
    a) NaCl b) CsCl c) Both (a) and (b) d) None of these
77. The formation of the oxide ion $O^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below,
    $O(g) + e \rightarrow O^-(g); \quad \Delta H = -142$ kJ/mol
    $O^-(g) + e \rightarrow O^{2-}(g); \quad \Delta H = 844$ kJ/mol
    These is because:
    a) O^- ion has comparatively larger size than oxygen atom
    b) Oxygen has high electron affinity
    c) O^- ion will lead to resist the addition of another electron
    d) Oxygen is more electronegative
78. Which among the following has the largest dipole moment?
    a) NH_3 b) H_2O c) HI d) SO_3
79. The correct order of radii is
    a) $N < Be < B$ b) $F^- < O^{2-} < N^{3-}$ c) $Fe^{3+} < Fe^{2+} < Fe^{4+}$ d) $Na < Li < K$
80. Diagonal relationship is for
    a) Li-Na b) Be-Mg c) Si-C d) B-Si

81. Bond order of 1.5 is shown by:
    a) O_2^{2-} b) O_2 c) O_2^+ d) O_2^-
82. Which one of the following is an amphoteric oxide?
    a) ZnO b) Na_2O c) SO_2 d) B_2O_3
83. Among, Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is
    a) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$ b) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$
    c) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$ d) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$
84. Point out the wrong statement. On moving horizontally from left to right across a period in the Periodic Table
    a) Metallic character decreases
    b) Electronegativity increases
    c) Gram atomic volume first decreases and then increases
    d) Size of the atoms increases for normal elements
85. The correct increasing bond angles order is:
    a) $BF_3 < NF_3 < PF_3 < ClF_3$
    b) $ClF_3 < PF_3 < NF_3 < BF_3$
    c) $BF_3 \approx NF_3 < PF_3 < ClF_3$
    d) $BF_3 < NF_3 < PF_3 > ClF_3$
86. The incorrect statement among the following is
    a) The first ionisation potential of Al is less than the first ionisation potential of Mg
    b) The second ionisation potential of Mg is greater than the second ionisation potential of Na
    c) The first ionisation potential of Na is less than the first ionisation potential of Mg
    d) The third ionisation potential of Mg is greater than that of Al
87. Concept of bond order in the molecular orbital theory depends on the number of electrons in the bonding and antibonding orbitals. The bond order:
    a) Can have a $-$ve value
    b) Has always an integral value
    c) Is a non-zero quantity
    d) Can assume any $+$ve value, including zero
88. Which hybridization results non-polar orbitals?
    a) sp b) sp^2 c) sp^3 d) dsp^2
89. The total number of valency electrons for PO_4^{3-} ion is:
    a) 32 b) 16 c) 28 d) 30
90. Intramolecular hydrogen bonding is found in:
    a) Salicyldehyde b) Water c) Acetaldehyde d) Phenol
91. Amphoteric oxide combinations are in
    a) ZnO, K_2O, SO_3 b) ZnO, P_2O_5, Cl_2O_7 c) SnO_2, Al_2O_3, ZnO d) PbO_2, SnO_2, SO_3
92. Chlorine atom tends to acquire the structure of:
    a) He b) Ne c) Ar d) Kr
93. Which of the following ion is the smallest ion?
    a) O_2 b) O_2^+ c) O_2^- d) O_2^{2-}
94. Variable valency is characteristic of:
    a) Noble gas
    b) Alkali metals
    c) Transition metals
    d) Non-metallic elements
95. Which force is strongest?
    a) Dipole-dipole forces
    b) Ion-ion forces
    c) Ion-dipole forces

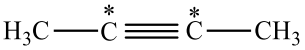
d) Ion-induced dipole forces

96. Identify the transition element.
a) $1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2$ b) $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^2, 4s^2$
c) $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^2$ d) $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^1$

97. For a covalent solid, the units which occupy lattice points are:
a) Atoms b) Ions c) Molecules d) Electrons

98. Which is not true in case of ionic bond?
a) It is linear bond
b) It is 100% ionic
c) It is formed between two atoms with large electronegativity difference
d) None of the above

99. In the following molecule, the two carbon atoms marked by asterisk ($*$) possess the following type of hybridized orbitals:



a) sp^3-orbital b) sp^2-orbital c) sp-orbital d) s-orbital

100. The element which exists in both hard and soft form is:
a) Fe b) Si c) C d) Al

101. Resonance is not shown by:
a) C_6H_6 b) CO_2 c) CO_3^{2-} d) SiO_2

102. The hybridization of P in PO_4^{3-} is same as in:
a) I in ICl_4^- b) S in SO_3 c) N in NO_3^- d) S in SO_4^{2-}

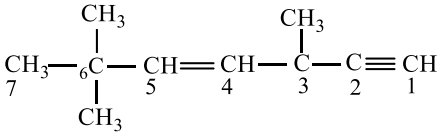
103. Dipole moment is highest for:
a) $CHCl_3$ b) CH_4 c) CHF_3 d) CCl_4

104. What is the correct decreasing order of ionic radii of following ions? $N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}$
a) $N^{3-} > O^{2-} > F^- > Mg^{2+} > Na^+$ b) $N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+}$
c) $N^{3-} > O^{2-} > Mg^{2+} > Na^+ > F^-$ d) $Na^+ > F^- > O^{2-} > Mg^{2+} > N^{3-}$

105. In which of the following crystals of ionic compounds would you expect maximum distance between the centres of cotions and anions
a) LiF b) CsF c) CsI d) LiI

106. Which of the following has lowest bond angle?
a) BeF_2 b) H_2O c) NH_3 d) CH_4

107. The state of hybridization of C_2, C_3, C_5 and C_6 of the hydrocarbon,



Is in the following sequence:
a) sp, sp^2, sp^3 and sp^2 b) sp, sp^3, sp^2 and sp^3 c) sp^3, sp^2, sp^2 and sp d) sp, sp^2, sp^2 and sp^3

108. Among the following elements Ca, Mg, P and Cl the order of increasing atomic radius is:
a) Mg < Ca < Cl < P b) Cl < P < Mg < Ca c) P < Cl < Ca < Mg d) Ca < Mg < P < Cl

109. Alkali metals in each period have:
a) Largest size
b) Lowest IE
c) Highest IE
d) Highest electronegativity

110. The critical temperature of water is higher than that of O_2 because H_2O molecules has:
a) Fewer electrons than O_2
b) Two covalent bonds
c) V-shape
d) Dipole moment

111. For diatomic species are listed below. Identify the correct order in which the bond order is increasing in them:
    a) $NO < O_2^- < C_2^{2-} < He_2^+$
    b) $O_2^- < NO < C_2^{2-} < He_2^+$
    c) $C_2^{2-} < He_2^+ < O_2^- < NO$
    d) $He_2^+ < O_2^- < NO < C_2^{2-}$
112. Which of the following is least ionic?
    a) CaF_2 b) $CaBr_2$ c) CaI_2 d) $CaCl_2$
113. The bond order of individual carbon-carbon bonds in benzene is:
    a) One
    b) Two
    c) Between 1 and 2
    d) One and two alternately
114. The total number of valency electrons in PH_4^+ ion is:
    a) 8 b) 9 c) 6 d) 14
115. Pauling's equation for determining the electronegativity of an element, is
    X_A, X_B =electronegativity values of elements A and B
    Δ=represents polarity of $A-B$ bond
    a) $X_A - X_B = 0.208\sqrt{\Delta}$ b) $X_A + X_B = 0.208\sqrt{\Delta}$ c) $X_A - X_B = 0.208\Delta^2$ d) $X_A - X_B = \sqrt{\Delta}$
116. The set representing the correct order of ionic radius is:
    a) $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$
    b) $Li^+ > Na^+ > Mg^{2+} > Be^{2+}$
    c) $Mg^{2+} > Be^{2+} > Li^+ > Na^+$
    d) $Li^+ > Be^{2+} > Na^+ > Mg^{2+}$
117. The pair having similar geometry is :
    a) BF_3, NH_3 b) BF_3, AlF_3 c) BeF_2, H_2O d) BCl_3, PCl_3
118. The attraction that non-polar molecules have for each other is primarily caused by:
    a) Hydrogen bonding
    b) Difference in electronegativities
    c) High ionisation energy
    d) Van der Waals' forces
119. The structure of ICl_2^- is:
    a) Trigonal
    b) Octahedral
    c) Square planar
    d) Distorted trigonal bipyramid
120. The correct order of increasing oxidising power is
    a) $F_2 < Cl_2 < I_2 > Br_2$ b) $F_2 < Br_2 < Cl_2 < I_2$ c) $Cl_2 < Br_2 < F_2 < I_2$ d) $I_2 < Br_2 < Cl_2 < F_2$
121. Which of the following oxides is not expected to react with sodium hydroxide?
    a) BeO b) B_2O_3 c) CaO d) SiO_2
122. In which molecule, the central atom does not use sp^3-hybrid orbitals in its bonding?
    a) NH_2^- b) BeF_3^- c) SO_2Cl_2 d) SO_4^{2-}
123. Which element has the lowest electronegativity?
    a) Li b) F c) Cl d) Fe
124. Amongst the following elements the configuration having the highest ionization energy is:
    a) $[Ne]3s^2 3p^1$ b) $[Ne]3s^2 3p^3$ c) $[Ne]3s^2 3p^2$ d) $[Ar]3d^{10}4s^2 4p^3$
125. Which species does not exist?
    a) $(SnCl_6)^{2-}$ b) $(GeCl_6)^{2-}$ c) $(CCl_6)^{2-}$ d) $(SiCl_6)^{2-}$
126. Which one of the following has not triangular pyramidal shape?
    a) NH_3 b) NCl_3 c) PF_3 d) BCl_3

127. Among NH_3, $BeCl_2$, CO_2 and H_2O, the non-linear molecules are:
a) $BeCl_2$ and H_2O b) $BeCl_2$ and CO_2 c) NH_3 and H_2O d) NH_3 and CO_2
128. When the hybridization state of carbon atom changes from sp^3 to sp^2 and finally to sp, the angle between the hybridized orbitals:
a) Decreases gradually
b) Decreases considerably
c) Is not affected
d) Increases progressively
129. Which is distilled first?
a) Liquid H_2 b) Liquid CO_2 c) Liquid O_2 d) Liquid N_2
130. The equilateral triangle shape has:
a) sp-hybridization b) sp^2-hybridization c) sp^3-hybridization d) sp^3d-hybridization
131. Which atomic orbital is always involved in sigma bonding only?
a) s b) p c) d d) f
132. Two ice cubes are pressed over each other and unite to form one cube. Which force is responsible for holding them together?
a) van der Waals' forces
b) Covalent attraction
c) Hydrogen bond formation
d) Dipole-dipole attraction
133. The decreasing values of bond angles from $NH_3(106°)$ to $SbH_3(101°)$ down group-15 of the periodic table is due to:
a) Increasing $bp - bp$ repulsion
b) Increasing p-orbital character in sp^3
c) Decreasing $lp - bp$ repulsion
d) Decreasing electronegativity
134. The bond that determines the secondary structure of a protein is:
a) Coordinate bond b) Covalent bond c) Hydrogen bond d) Ionic bond
135. Which is not an exception to octet rule?
a) BF_3 b) $SnCl_4$ c) BeI_2 d) ClO_2
136. Higher is the bond order, greater is:
a) Bond dissociation energy
b) Covalent character
c) Bond length
d) Paramagnetism
137. Highest electron affinity among the following is
a) Fluorine b) Chlorine c) Sulphur d) Xenon
138. According to molecular orbital theory for O_2^+:
a) Bond order is less than O_2 and O_2^+ is paramagnetic
b) Bond order is more than O_2 and O_2^+ is paramagnetic
c) Bond order is less than O_2 and O_2^+ is diamagnetic
d) Bond order is more than O_2 and O_2^+ is diamagnetic
139. Which of the following has fractional bond order?
a) O_2^{2+} b) O_2^{2-} c) F_2^{2-} d) H_2^-
140. Which of the following is not isostructural with $SiCl_4$?
a) PO_4^{3-} b) NH_4^+ c) SCl_4 d) SO_4^{2-}
141. The correct order of decreasing second ionisation enthalpy of Ti (22), V (23), Cr (24) and Mn (25) is:
a) V > Mn > Cr > Ti b) Mn > Cr > Ti > V c) Ti > V > Cr > Mn d) Cr > Mn > V > Ti
142. The electrons used in bonding atoms:
a) Belong to outermost shell

b) Belong to penultimate shell
c) Belong to outermost shell and sometimes penultimate shell
d) Belong to penultimate shell and sometimes to outermost shell

143. The discovery of which of the following group of elements gave death blow to the Newland's law of octaves?
a) Inert gases b) Alkaline earths c) Rare earths d) Actinides

144. Generally, the first ionisation energy increases along a period. But there are some exceptions. One which is not an exception is
a) N and O b) Na and Mg c) Mg and Al d) Be and B

145. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides?
a) $Al_2O_3 < MgO < Na_2O < K_2O$ b) $MgO < K_2O < Al_2O_3 < Na_2O$
c) $Na_2O < K_2O < MgO < Al_2O_3$ d) $K_2O < Na_2O < Al_2O_3 < MgO$

146. The basis of keeping the elements in the groups of The Periodic Table is
a) Ionisation potential b) Electronegativity
c) Electron affinity d) Number of valence electrons

147. I^{st} and II^{nd} IE of Mg are 7.646 and 15.035 eV respectively. The amount of energy needed to convert all the atoms of magnesium into Mg^{2+} ions present in 12 mg of magnesium vapours is [Given, 1eV = 96.5 kJ mol^{-1}]
a) 1.5 b) 2.0 c) 1.1 d) 0.5

148. $K^+, Cl^-, Ca^{2+}, S^{2-}$ ions are isoelectronics. The decreasing order of their size is:
a) $S^{2-} > Cl^- > K^+ > Ca^{2+}$
b) $Ca^{2+} > K^+ > Cl^- > S^{2-}$
c) $K^+ > Cl^- > Ca^{2+} > S^{2-}$
d) $Cl^- > S^{2-} > Ca^{2+} > K^+$

149. The first four ionisation energy values of an element are 191, 578, 872 and 5962 kcal. The number of valence electrons in the element is
a) 1 b) 2 c) 3 d) 4

150. Which are true statements among the following?
(1) PH_5 and $BiCl_5$ does not exist
(2) $p\,\pi - d\pi$ bonds are present in SO_2
(3) Electrons travel with speed of light
(4) SeF_4 and CH_4 has same shape
(5) I_3^+ has bent geometry
a) 1, 3 b) 1, 2, 5 c) 1, 3, 5 d) 1, 2, 4

151. Correct increasing order of first ionisation potential is
a) $Na < Mg > Al < Si$ b) $Na < Mg < Al < Si$ c) $Na > Mg > Al > Si$ d) $Na < Mg < Al > Si$

152. Which pair represents isostructural species?
a) CH_3^- and CH_3^+ b) NH_4^+ and NH_3 c) SO_4^{2-} and BF_4^- d) NH_2^- and BeF_2

153. The first ionisation potential (eV) of Be and B respectively are
a) 8.29 eV, 8.29 eV b) 8.29 eV, 9.32 eV c) 9.32 eV, 9.32 eV d) 9.32 eV, 8.29 eV

154. The correct order according to size is
a) $O > O^- > O^{2-}$ b) $O^- > O^{2-} > O$ c) $O^{2-} > O^- > O$ d) $O > O^{2-} > O^-$

155. The correct order of electron affinity is
a) $B < C < O > N$ b) $B > C > N > O$ c) $O > C > B > N$ d) $O < C < B < N$

156. Which of the following is a false statement?
a) Fluorine is more electronegative than chlorine b) Nitrogen has greater IE_1 than oxygen
c) Lithium is amphoteric d) Chlorine is an oxidising agent

157. Solid NaCl is a bad conductor of electricity because:
a) In solid NaCl there are no ions

b) Solid NaCl is covalent
c) In solid NaCl there is no velocity of ions
d) In solid NaCl there are no electrons

158. Which of the following configuration is associated with biggest jump between 2nd and 3rd IE?
a) $1s^2, 2s^2 2p^2$ b) $1s^2, 2s^2 2p^6, 3s^1$ c) $1s^2, 2s^2 2p^6, 3s^2$ d) $1s^2, 2s^2 2p^1$

159. Consider the ions K^+, S^{2-}, Cl^- and Ca^{2+}. The radii of these ionic species follow the order
a) $Ca^{2+} > K^+ > Cl^- > S^{2-}$ b) $Cl^- > S^{2-} > K^+ > Ca^{2+}$
c) $Ca^{2+} > Cl^- > K > S^{2-}$ d) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

160. The correct order of ionisation energy for comparing carbon, nitrogen and oxygen is
a) C < N > O b) C > N < O c) C > N > O d) C < N < O

161. A π-bond is formed by sideways overlapping of:
a) s-s orbitals b) p-p orbitals c) s-p orbitals d) s-p-s orbitas

162. Which oxide of nitrogen is isoelectronic with CO_2?
a) NO_2 b) N_2O c) NO d) N_2O_2

163. In which of the following pairs of molecules/ions, the central atom has sp^2-hybridization?
a) NO_2 and NH_3 b) BF_3 and NO_2^- c) NH_2^- and H_2O d) BF_3 and NH_2^-

164. Which of the following has largest ionic radius?
a) Cs^+ b) Li^+ c) Na^+ d) K^+

165. Boron cannot form which one of the following anions?
a) BF_6^{3-} b) BH_4^- c) $B(OH)_4^-$ d) BO_2^-

166. Most covalent halide of aluminium is:
a) $AlCl_3$ b) AlI_3 c) $AlBr_3$ d) AlF_3

167. The shape of ClO_3^- according to VSEPR model is:
a) Planar triangle b) Pyramidal c) Tetrahedral d) Square planar

168. The correct order of increasing bond angles in the following triatomic species is:
a) $NO_2^- < NO_2 < NO_2^+$ b) $NO_2^+ < NO_2 < NO_2^-$ c) $NO_2^+ < NO_2^- < NO_2$ d) $NO_2^- < NO_2^+ < NO_2$

169. Which of the following pairs has both members from the same group of the Periodic Table?
a) Mg − Ba b) Mg − Cu c) Mg − K d) Mg − Na

170. Silicon has 4 electrons in the outermost orbit. In forming the bond:
a) It gains electrons b) It losses electrons c) It shares electrons d) None of these

171. sp^2-hybridization is shown by:
a) $BeCl_2$ b) BF_3 c) NH_3 d) XeF_2

172. A p-block element in which last electron enters into s-orbitals of valence shell instead of p-orbital is:
a) As b) Ga c) No such element exist d) He

173. Which of the following are not correct?
a) Lone pair of electrons present on central atom can give rise to dipole moment
b) Dipole moment is vector quantity
c) CO_2 molecule has dipole moment
d) Difference in electronegativities of combining atoms can lead to dipole moment

174. The order of first ionisation energies of the element Li, Be, B, Na is
a) Li > $Be > B > Na$ b) Be > $B > Li > Na$ c) Na > $Li > B > Be$ d) Be > $Li > B > Na$

175. Differentiating electron in inner transition elements enters the…….. orbital.
a) s b) p c) d d) f

176. Which is expected to conduct electricity?
a) Diamond b) Molten sulphur c) Molten KCl d) Crystalline NaCl

177. Elements whose electronegativities are 1.2 and 3.0, form:
a) Ionic bond b) Covalent bond c) Coordinate bond d) Metallic bond

178. Which is the correct order of ionic sizes?) At. no. : Ce = 58, Sn = 50, Yb = 70 and Lu = 71)
a) Ce > Sn > Yb > Lu b) Sn > Yb > Ce > Lu c) Sn > Ce > Yb > Lu d) Lu > Yb > Sn > Ce

179. Oxygen is divalent, but sulphur exhibits variable valency of 2, 4 and 6, because:

a) Sulphur is less electronegative than oxygen
b) Sulphur is bigger atom than oxygen
c) Ionisation potential of sulphur is more than oxygen
d) Of the presence of d-orbitals in sulphur

180. In the Periodic Table, going down in the fluorine group
a) Stability of hydrides will increases
b) Ionic radii will increases
c) Electronegativity will increases
d) IE will increases

181. The ionisation energy of nitrogen is larger than that of oxygen because of
a) Of greater attraction of electrons by the nucleus
b) Of the size of nitrogen atom being smaller
c) The half-filled p-orbitals possess extra stability
d) Of greater penetration effect

182. Which has the highest ionisation potential?
a) Na
b) Mg
c) C
d) F

183. Which of the following does not represents the correct order of the property indicated?
a) $Sc^{3+} > Cr^{3+} > Fe^{3+} > Mn^{3+}$ −ionic radii
b) $Sc < Ti < Cr < Mn$ − density
c) $Mn^{2+} > Ni^{2+} > Co^{2+} < Fe^{2+}$ − ionic radii
d) $FeO < CaO < MnO < CuO$ − basic nature

184. The electronic configuration of most electronegative elements is
a) $1s^2, 2s^2, 2p^5$
b) $1s^2, 2s^2, 2p^4, 3s^1$
c) $1s^2, 2s^2, 2p^6, 3s^1, 3p^1$
d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$

185. Which group of the Periodic Table does not contain only metals?
a) IB
b) IA
c) IIA
d) IIIA

186. The species showing $p\pi - d\pi$ overlapping is:
a) NO_3^-
b) PO_4^{3-}
c) CO_3^{2-}
d) NO_2^-

187. Variable oxidation state and degenerated orbital shows
a) s-block elements
b) p-block elements
c) d-block elements
d) All of these

188. Which of the following is a metalloid?
a) Sb
b) Mg
c) Zn
d) Bi

189. Which does not use sp^3-hybrid orbitals in its bonding?
a) BeF_3^-
b) OH_3^+
c) NH_4^+
d) NF_3

190. Which of the following have highest electron affinity?
a) N
b) O
c) F
d) Cl

191. The correct order of increasing electropositive character among Cu, Fe and Mg is:
a) Cu ≈ Fe < Mg
b) Fe < Cu < Mg
c) Fe < Mg < Cu
d) Cu < Fe < Mg

192. As one moves along a given row in the Periodic Table, ionisation energy
a) Increases from left to right
b) Decreases from left to right
c) First increases, then decreases
d) Remains the same

193. The lightest metal is
a) Li
b) Na
c) Mg
d) Ca

194. Which is the property of non-metal?
a) Electronegative
b) Basic nature of oxide
c) Reducing property
d) Low ionisation potential

195. In a given shell the order of screening effect is
a) $s > p > d > f$
b) $s > p > f > d$
c) $f > d > p > s$
d) $s < p < d < f$

196. Among the following compounds the one that is polar and has central atom with sp^2-hybridisation is:
a) H_2CO_3
b) SiF_4
c) BF_3
d) $HClO_2$

197. The formation of the oxide ion $O^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below;
$O(g) + e^- = O^-(g);\ \Delta H° = -142\ kJmo1^{-1}$
$O(g)^- + e^- = O^{2-}(g); \Delta H° = 844\ kJmo1^{-1}$
This is because

a) Oxygen is more electronegative
b) Oxygen has high electron affinity
c) O^-ion will tend to resist the addition of another electron
d) O^-has comparatively larger size than oxygen atom

198. Which of the following statements is correct?
a) X^- ion is larger in size than X-atom
b) X^+ ion is larger in size than X-atom
c) X^+ ion is larger in size than X^- ion
d) X^+ and X^- ions are equal in size

199. Number of elements presents in the fifth period of periodic table is
a) 32 b) 10 c) 18 d) 8

200. The compound possessing most strongly ionic nature is:
a) $SrCl_2$ b) $BaCl_2$ c) $CaCl_2$ d) CsCl

201. What is the name of element with atomic number 105?
a) Kurchatovium b) Dubnium c) Nobelium d) Holmium

202. Among the following which is the strongest oxidising agent?
a) Cl_2 b) F_2 c) Br_2 d) I_2

203. The outermost electronic configuration of the most electronegative element is
a) ns^2np^3 b) ns^2np^4 c) ns^2np^5 d) ns^2np^6

204. The incorrect statements regarding bonding molecular orbitals because:
a) Bonding molecular orbital possess less energy than combining atomic orbitals.
b) Bonding molecular orbitals have low electron density between the two nuclei.
c) Every electron in bonding molecular orbitals contributes to attraction between atoms.
d) They are formed when the lobes of the combining atomic orbitals have same sign.

205. Which of the following has largest size?
a) Al b) Al^+ c) Al^{2+} d) Al^{3+}

206. Carbon atoms in $C_2(CN)_4$ are:
a) sp-hybridized b) sp^2-hybridized c) sp-and sp^2- hybridized d) sp, sp^2 and sp^3-hybridized

207. The common feature among the species CN^-, CO and NO^+ are:
a) Bond order three and isoelectronic
b) Bond order three and weak filed ligands
c) Bond order two and π-acceptors
d) Isoelectronic and weak filed ligands

208. Which one of the elements has the maximum electron affinity?
a) F b) Cl c) Br d) I

209. The internuclear distance in H_2 and Cl_2 molecules are 74 and 198 pm respectively. The bond length of H − Cl may be:
a) 272 pm b) 70 pm c) 136 pm d) 248 pm

210. PCl_5 exists but NCl_5 does not because:
a) Nitrogen has no vacant $2d$-orbitals
b) NCl_5 is unstable
c) Nitrogen atom is much smaller than p
d) Nitrogen is highly highly inert

211. Which one of the following process requiring absorption of energy?
a) $Cl \rightarrow Cl^-$ b) $H \rightarrow H^-$ c) $O \rightarrow O^{2-}$ d) $F \rightarrow F^-$

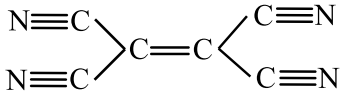
212. The hybridization of carbon in diamond, graphite and acetylene is:
a) sp^3, sp^2, sp b) sp^3, sp, sp^2 c) sp^2, sp^3, sp d) $sp, sp^3 sp^2$

213. Which ionisation potential (IP) in the following equations involves the greatest amount of energy?
a) $K^+ \rightarrow K^{2+} + e^-$ b) $Na \rightarrow Na^+ + e^-$ c) $C^{2+} \rightarrow C^{3+} + e^-$ d) $Ca^+ \rightarrow Ca^{2+} + e^-$

214. The pairs of bases in DNA are held together by:
a) Hydrogen bonds b) Ionic bonds c) Phosphate groups d) Deoxyribose groups

215. The energy of $\sigma 2s$-orbital is greater than $\sigma^* 1s$ orbital because:
   a) $\sigma 2s$ orbital is bigger than $\sigma 1s$ orbital
   b) $\sigma 2s$ orbital is a bonding orbital whereas, $\sigma^* 1s$ an antibonding orbital
   c) $\sigma 2s$ orbital has a greater value of n than $\sigma^* 1s$ orbital
   d) None of the above
216. Who developed the long form of Periodic Table?
   a) Niels Bohr b) Moseley c) Mendeleef d) Lothar Meyer
217. At ordinary temperature and pressure, among halogens, the chlorine is a gas, bromine is a liquid and iodine is a solid. This is because:
   a) The specific heat is in the order $Cl_2 > Br_2 > I_2$
   b) Intermolecular forces among molecules of chlorine are the weakest and those in iodine are the strongest
   c) The order of density is $I_2 > Br_2 > Cl_2$
   d) The order of stability is $Cl_2 > Br_2 > I_2$
218. The radii F, F^-, O and O^{2-} are in the order of
   a) $F^- > O^{2-} > F > O$ b) $F > F^- > O > O^{2-}$ c) $O^{2-} > F^- > O > F$ d) $F > O > F^- > O^{2-}$
219. Which of the following is the smallest in size?
   a) Na^+ b) F^- c) O^{2-} d) N^{3-}
220. Which of the following pairs show reverse properties on moving along a period from left to right and from top to down in a group?
   a) Nuclear charge and electron affinity b) Ionisation energy and electron affinity
   c) Atomic radius and electron affinity d) None of the above
221. Which of the following relation is correct?
   a) I^{st} IE of C > I^{st} IE of B b) I^{st} IE of C < I^{st} IE of B
   c) II^{nd} IE of C > II^{nd} IE of B d) Both (b) and (c)
222. KF combines with HF to form KHF_2. The compound contains the species:
   a) K^+, F^- and H^+ b) K^+, F^- and HF c) K^+ and $[HF_2]^-$ d) $[KHF]^+$ and F^-
223. The bond angle between $H - O - H$ in ice is closest to:
   a) 115° b) 109°28′ c) 110° d) 90°
224. Which has higher bond energy and stronger bond?
   a) F_2 b) Cl_2 c) Br_2 d) I_2
225. The example of the p-p-orbital overlapping is the formation of:
   a) H_2 molecule
   b) Cl_2 molecule
   c) Hydrogen chloride
   d) Hydrogen bromide molecule
226. In compound X, all the bond angles are exactly 109°28′, X is:
   a) Chloromethane b) Iodoform c) Carbon tetrachloride d) Chloroform
227. Which of the following species has four lone pairs of electrons in its outer shell?
   a) I b) O^- c) Cl^- d) He
228. The type of bond formed between H^+ and NH_3 in NH_4^+ ion is:
   a) Ionic b) Covalent c) Dative d) Hydrogen
229. Which transition involves maximum amount of energy?
   a) $M^-(g) \rightarrow M(g) + e$
   b) $M^-(g) \rightarrow M^+(g) + 2e$
   c) $M^+(g) \rightarrow M^{2+}(g) + e$
   d) $M^{2+}(g) \rightarrow M^{3+}(g) + e$
230. The order of stability of metal oxides is
   a) $Al_2O_3 < MgO < Fe_2O_3 < Cr_2O_3$ b) $Cr_2O_3 < MgO < Al_2O_3 < Fe_2O_3$
   c) $Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$ d) $Fe_2O_3 < Al_2O_3 < Cr_2O_3 < MgO$

231. The first ionisation potential of Na, Mg, Al and Si are in the order
a) Na $< Mg > Al < Si$ b) Na $> Mg > Al < Si$ c) Na $< Mg < Al > Si$ d) Na $> Mg > Al < Si$
232. The electronic configuration of 4 elements K, L, M and N are,
$K = 1s^2, 2s^2 2p^1$ $L = 1s^2, 2s^2 2p^6$
$M = 1s^2, 2s^2 2p^4$ $N = 1s^2, 2s^2 2p^3$
The element that would form a diatomic molecule with double bond is:
a) K b) L c) M d) N
233. In the formation of N_2^+ from N_2, the electron is lost from:
a) a σ-orbital b) a π-orbital c) a σ^*-orbital d) a π^*-orbital
234. Which of the following two are isostructural?
a) XeF_2, IF_2^- b) NH_3, BF_3 c) CO_3^{2-}, SO_3^{2-} d) PCl_5, ICl_5
235. Which has sp^2-hybridization?
a) CO_2 b) SO_2 c) N_2O d) CO
236. Which of the following metal oxides is most basic?
a) ZnO b) Al_2O_3 c) As_2O_3 d) K_2O
237. Which of the following phenomenon will occur when two atoms of same spin will react?
a) Bonding will not occur
b) Orbital overlap will not occur
c) Both (a) and (b)
d) None of the above
238. The bonds present in N_2O_5 are:
a) Ionic
b) Covalent and coordinate
c) Covalent
d) Ionic and covalent
239. How many σ-and π-bonds are there in the molecule of tetracyanoethylene?



a) Nine σ- and nine π b) Five σ- and nine π c) Nine σ- and seven π d) Five σ- and eight π
240. The maximum valency of an element with atomic number 7 is
a) 2 b) 3 c) 4 d) 5
241. Which of the following compounds has the lowest melting point?
a) CaF_2 b) $CaCl_2$ c) $CaBr_2$ d) CaI_2
242. Nitrogen dioxide cannot be prepared by heating
a) KNO_3 b) $Pb(NO_3)_2$ c) $Cu(NO_3)_2$ d) $AgNO_3$
243. Which of the following is correct order of increasing size?
a) $Br^- > S^{2-} > Cl^- > Na^+ > Mg^{2+} > Be^{2+}$ b) $Be^{2+} > Mg^{2+} > Na^+ > S^{2-} > Cl^- > Br^-$
c) $S^{2-} > Cl^- > Br^- > Na^+ > Mg^{2+} > Be^{2+}$ d) $Na^+ > Mg^{2+} > Be^{2+} > Br^- > Cl^- > S^{2-}$
244. The correct order of bond angles is:
a) $PF_3 < PCl_3 < PBr_3 < PI_3$
b) $PF_3 < PBr_3 < PCl_3 < PI_3$
c) $PI_3 < PBr_3 < PCl_3 < PF_3$
d) $PF_3 > PCl_3 < PBr_3 < PI_3$
245. Among the following metals interatomic forces are probably weakest in:
a) Cu b) Ag c) Zn d) Hg
246. The element with atomic number 117 if discovered would be placed in
a) Noble gas family b) Alkali family c) Alkaline earth family d) Halogen family
247. The element with atomic numbers 9, 17, 35, 53, 85 are all
a) Noble gases b) Halogens c) Heavy metals d) Light metals
248. Acetic acid exists as dimer in benzene due to:

a) Condensation reaction
b) Hydrogen bonding
c) Presence of carboxyl group
d) Presence of hydrogen atom at α-carbon

249. In which of the following arrangements the order is not correct according to property indicated against it?
a) Increasing size : $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$
b) Increasing IE_1 : $B < C < N < O$
c) Increasing EA_1 : $I < Br < F < Cl$
d) Increasing metallic radius: $Li < Na < K < Rb$

250. The forces present in the crystals of naphthalene are:
a) Van der Waals' forces b) Electrostatic forces c) Hydrogen bonding d) None of these

251. Which has zero dipole moment?
a) ClF b) PCl_3 c) SiF_4 d) $CFCl_3$

252. Which group of the Periodic Table contains coinage metal?
a) IIA b) IB c) IA d) None of these

253. The bond angle and hybridization in ether (CH_3OCH_3) is:
a) $106° 51', sp^3$ b) $104° 31', sp^3$ c) $110°, sp^3$ d) None of these

254. Ionisation potential values of $'d'$ block elements as compared to ionisation potential values of $'f'$ block elements are:
a) Higher b) Lower c) Equal d) Either of these

255. How many bonded electron pairs are present in IF_7 molecule?
a) 6 b) 7 c) 5 d) 8

256. Formation of π-bond:
a) Increases bond length
b) Decreases bond length
c) Distorts the geometry of molecule
d) Makes homoatomic molecules more reactive

257. An element with atomic number 20 will be placed in which period of the Periodic Table?
a) 1 b) 2 c) 3 d) 4

258. Which bond angle results in the minimum dipole moment for the triatomic molecule XY_2 shown below?
a) 90° b) 120° c) 150° d) 180°

259. NH_3 has a net dipole moment, but boron trifluoride (BF_3) has zero dipole moment, because:
a) B is less electronegative than N
b) F is more electronegative than H
c) BF_3 is pyramidal while NH_3 is planar
d) NH_3 is pyramidal while BF_3 is trigonal planar

260. The geometry of PF_5 molecule is:
a) Planar b) Square planar c) Trigonal bipyramidal d) Tetrahedral

261. The correct order of ionisation energy for comparing carbon, nitrogen and oxygen atom is
a) $C > N > O$ b) $C > N < O$ c) $C < N > O$ d) $C < N < O$

262. In which of the following arrangements the order is not according to the property indicated against it?
a) $Li < Na < K < Rb$ increasing metallic radius
b) $I < Br < F < Cl$ increasing electron gain enthaly (with negative sign)
c) $B < C < N < O$ increasing first ionisation enthalphy
d) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$ increasing ionic size

263. Pauling received Nobel Prize for his work on:
a) Photosynthesis b) Atomic structure c) Chemical bonding d) Thermodynamics

264. For electron affinity of halogens, which of the following is correct?
a) $F > Cl$ b) $F < I$ c) $Br > F$ d) $Br < Cl$

265. The correct electronegativity order is:

a) C, N, Si, P b) N, Si, C, P c) Si, P, C, N d) P, Si, N, C

266. Which of the following properties show gradual decrease with increase in atomic number across a period in the Periodic Table?
a) Electron affinity b) Ionisation potential c) Electronegativity d) Size of atom

267. Difference between S and S^{2-}as S^{2-} has
a) Larger radii and larger size
b) Smaller radii and larger size
c) Larger radii and smaller size
d) Smaller radii and smaller size

268. Two lone pairs of electrons and two bond pairs are present in:
a) NH_3 b) BF_3 c) CO_3^{2-} d) NH_2^-

269. The lattice energy order for lithium halide is:
a) $LiF > LiCl > LiBr > LiI$
b) $LiCl > LiF > LiBr > LiI$
c) $LiBr > LiCl > LiF > LiI$
d) $LiI > LiBr > LiCl > LiF$

270. The number of σ and π-bonds in pent-4-en-1-yne are respectively:
a) 3, 10 b) 9, 4 c) 4, 9 d) 10, 3

271. The correct increasing order off polarising power is:
a) $Ca^{2+} < Mg^{2+} < Be^{2+} < K^+$
b) $Mg^{2+} < Be^{2+} < K^+ < Ca^{2+}$
c) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$
d) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$

272. Increase in atomic size down the group is due to
a) Increase in number of electrons
b) Increase in number of protons and neutrons
c) Increase in number of protons
d) Increase in number of protons, neutrons and electrons

273. When the first ionisation energies are plotted against atomic number, the peaks are occupied by
a) Alkali metals b) Halogens c) Transition metals d) Rare gases

274. Which of the following is non-metallic?
a) B b) Be c) Mg d) Al

275. Structure of ICl_2^- is:
a) Trigonal
b) Octahedral
c) Square planar
d) Distorted trigonal pyramidal

276. Which compound does not contain double bond or triple bond?
a) C_2H_4 b) H_2O c) N_2 d) HCN

277. The correct order of increasing oxidising power is
a) $F_2 < Cl_2 < Br_2 < I_2$ b) $I_2 < F_2 < Cl_2 < Br_2$
c) $Br_2 < I_2 < F_2 < Cl_2$ d) $I_2 < Br_2 < Cl_2 < F_2$

278. Which is soluble in water?
a) AgF b) AgCl c) AgBr d) AgI

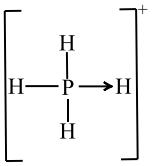
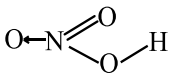
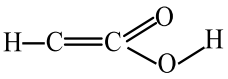
279. Highest energy will be absorbed to eject out the electron in the configuration
a) $1s^2 2s^2 2p^1$ b) $1s^2 2s^2 2p^3$ c) $1s^2 2s^2 2p^2$ d) $1s^2 2s^2 2p^4$

280. Most acidic oxide is
a) Na_2O b) ZnO c) MgO d) P_2O_5

281. The process requiring the absorption of energy is:
a) $F \rightarrow F^-$ b) $H \rightarrow H^-$ c) $Cl \rightarrow Cl^-$ d) $O \rightarrow O^{2-}$

282. Each of the followings has non-zero dipole moment, except:
a) C_6H_6 b) CO c) SO_2 d) NH_3

283. H-bonding is not present in:
a) Glycerine b) Water c) H_2S d) HF

284. Which formulae does not correctly represent the bonding capacity of the atom involved?
a)  b)  c)  d) 

285. The higher values of specific heat of water in comparison to other liquids is due to:
a) High dielectric constant
b) Polarity
c) H-bonding
d) None of the above

286. Which one of the following combinations represents a metallic element?
a) 2, 8, 2 b) 2, 8, 4 c) 2, 8, 7 d) 2, 8, 8

287. Which bond has the highest bond energy?
a) Coordinate bond b) Sigma bond c) Multiple bond d) Polar covalent bond

288. The increasing order of first ionisation enthalpies of the elements B, P, S and F (lowest first) is
a) $F < S < P < B$ b) $P < S < B < F$ c) $B < P < S < F$ d) $B < S < P < F$

289. Which of the following pairs are isostructural?
a) SO_3^{2-}, NO_3^- b) BF_3, NF_3 c) BrO_3^-, XeO_3 d) SF_4, XeF_4

290. The electronic configuration of transition elements is exhibited by
a) $(n-1)d^{1-10}, ns^2$ b) $ns^2(n-1)d^{10}$ c) ns^1 d) ns^2, np^5

291. The bond strength in O_2^+, O_2, O_2^- and O_2^{2-} follows the order:
a) $O_2^{2-} > O_2^- > O_2 > O_2^+$ b) $O_2^+ > O_2 > O_2^- > O_2^{2-}$ c) $O_2 > O_2^- > O_2^{2-} > O_2^+$ d) $O_2^- > O_2^{2-} > O_2^+ > O_2$

292. The first ionisation energy of oxygen is less than that of nitrogen. Which of the following is the correct reason for this observation?
a) Lesser effective nuclear charge of oxygen than nitrogen
b) Lesser atomic size of oxygen than nitrogen
c) Greater interelectron repulsion between two electrons in the same *p*-orbital counter balances the increase in effective nuclear charge on moving from nitrogen to oxygen
d) Greater effective nuclear charge of oxygen than nitrogen

293. A C ≡ C bond is :
a) Weaker than C = C bond
b) Weaker than C − C bond
c) Longer than C − C bond
d) Shorter than C = C bond

294. Which is likely to have the highest melting point?
a) He b) CsF c) NH_3 d) $CHCl_3$

295. Which of the two ions from the list given below that have the geometry that is explained by the same hybridization of orbitals, $NO_2^-, NO_3^-, NH_2^-, NH_4^+, SCN^-$?
a) NO_2^- and NH_2^- b) NO_2^- and NO_3^- c) NH_4^+ and NO_3^- d) SCN^- and NH_2^-

296. Valency means:
a) Combining capacity of an element
b) Atomicity of an element
c) Oxidation number of an element
d) None of the above

297. The hybridization of carbon atoms in C − C single bond of $HC \equiv C - CH = CH_2$ is:
a) $sp^3 - sp^3$ b) $sp^2 - sp^3$ c) $sp - sp^2$ d) $sp^3 - sp$

298. The IP_1 is maximum for:
a) K b) Na c) Be d) He

299. Which of the following has highest bond angle?
a) H_2O b) H_2S c) NH_3 d) PH_3
300. The halogen that most easily reduced is
a) F_2 b) Cl_2 c) Br_2 d) I_2
301. The enhanced force of cohesion in metals is due to:
a) The covalent linkages between atoms
b) The electrovalent linkages between atoms
c) The lack of exchange of valency electrons
d) The exchange energy of mobile electrons
302. Which contains both polar and non-polar covalent bonds?
a) NH_4Cl b) HCN c) H_2O_2 d) CH_4
303. Electron deficient species are known as:
a) Lewis acids b) Hydrophilic c) Nucleophiles d) Lewis bases
304. Metallic bonds do not play a role in:
a) Brass b) Copper c) Germanium d) Zinc
305. A number of ionic compounds, $e.g.$, AgCl, CaF_2, $BaSO_4$ are insoluble in water. This is because:
a) Ionic compounds do not dissolve in water
b) Water has a high dielectric constant
c) Water is not a good ionizing solvent
d) These molecules have exceptionally high attractive forces in their lattice
306. Pauling's electronegativity values for elements are useful in predicting:
a) Polarity of bonds in molecules
b) Position of elements in electromotive series
c) Coordination number
d) Dipole moment of various molecules
307. Among the following elements, the most electronegative is:
a) Oxygen b) Chlorine c) Nitrogen d) Fluorine
308. The correct order of decreasing first ionization potential is:
a) C > B > Be > Li b) C > Be > B > Li c) B > C > Be > Li d) Be > Li > B > C
309. Ionization potential of Na would be numerically the same as:
a) Electron affinity of Na^+
b) Electronegativity of Na^+
c) Electron affinity of He
d) Ionization potential of Mg
310. The atomic number of elements A, B, C and D are $Z-1$, $Z+1$, and $Z+2$, respectively. If 'B' is a noble gas, choose the correct answer from the following statements.
V. 'A' has higher electron affinity
VI. 'C' exists in $+2$ oxidation state
VII. 'D' is an alkaline earth metal
a) I and II b) II and III c) I and III d) I, II and III
311. The type of hybridization of sulphur atom present in SO_2 and SO_3 is respectively:
a) sp, sp^2 b) sp^2, sp^2 c) sp^2, sp^3 d) sp, sp^3
312. Dipole moment is exhibited by:
a) 1, 4-dichlorobenzene
b) 1, 2-dichlorobenzene
c) $Trans$-1, 2-dichloroethene
d) $Trans$-1, 2-dicloro-2-butene
313. The formation of the oxide ion $O^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below $O(g) + e^- = O^-(g)$; $\Delta H^o = -142$ kJ mol^{-1}
$O^-(g) + e^- = O^{2-}(g), \Delta H^o = 844$ kJ mol^{-1} This is because

a) O^- ion will tend to resist the addition of another electron
b) Oxygen has high electro affinity
c) Oxygen is more electronegative
d) O^- ion has comparatively larger size than oxygen atom

314. Which pair of the atomic numbers represents *s*-block elements?
a) 3, 12 b) 6, 12 c) 7, 15 d) 9, 17

315. Which of the following does not reflect the periodicity of elements?
a) Bonding behaviour b) Electronegativity c) Ionisation potential d) Neutron/proton ratio

316. In the Periodic Table metals usually used as catalyst belong to
a) f-block b) d-block c) p-block d) s-block

317. Four diatomic species are listed below in different sequences. Which of these represents the correct order of their increasing bond order?
a) $NO < C_2^{2-} < O_2^- < He_2^+$
b) $C_2^{2-} < He_2^+ < NO < O_2^-$
c) $He_2^+ < O_2^- < NO < C_2^{2-}$
d) $O_2^- < NO < C_2^{2-} < He_2^+$

318. The increase in bond order results in:
a) Decrease in bond length and increase in bond energy
b) Decrease in bond length and bond energy
c) Increase in bond length and bond energy
d) None of the above

319. In which molecule all atoms are coplanar?
a) CH_4 b) BF_3 c) PF_3 d) NH_3

320. Length of hydrogen bond ranges from 2.5 Å to:
a) 3.0 Å b) 2.75 Å c) 2.6 Å d) 3.2 Å

321. XeF_6 is:
a) Octahedral
b) Pentagonal pyramidal
c) Planar
d) Tetrahedral

322. HCl molecule in the vapour state is an example of:
a) Non-polar bond b) Ionic bond c) Polar covalent bond d) Pure covalent bond

323. Which of the following species has a linear shape?
a) NO_2^+ b) O_3 c) NO_2^- d) SO_2

324. Which represents a collection of isoelectronic species?
a) Be, Al^{3+}, Cl^- b) Ca^{2+}, Cs^+, Br c) Na^+, Ca^{2+}, Mg^{2+} d) N^{3-}, F^-, Na^+

325. In which of the following molecules/ions are all the bonds not equal?
a) SF_4 b) SiF_4 c) XeF_4 d) BF_4^-

326. Solid CH_4 is:
a) Molecular solid b) Ionic solid c) Covalent solid d) Not exist

327. Which has the highest bond energy?
a) Hydrogen bond b) Triple bond c) Double bond d) Single bond

328. The electron affinity values (in kJ mol^{-1}) of three halogens X,Y and Z are respectively $-349, -333$ and -325. Then X, Y and Z respectively, are
a) $F_2, Cl_2$and Br_2 b) Cl_2, F_2 and Br_2 c) Cl_2, Br_2 and F_2 d) $Br_2, Cl_2$and F_2

329. According to MO theory, which of the following lists ranks the nitrogen species in terms of increasing bond order?
a) $N_2^- < N_2^{2-} < N_2$ b) $N_2^- < N_2 < N_2^{2-}$ c) $N_2^{2-} < N_2^- < N_2$ d) $N_2 < N_2^{2-} < N_2^-$

330. Be resembles much with
a) Li b) Al c) Zn d) Ra

331. The pair of species with the same bond order is:
a) NO, CO b) N_2, O_2 c) O_2^{2-}, B_2 d) O_2^+, NO^+

332. Which molecule is planar?
a) NH_3 b) CH_4 c) C_2H_4 d) $SiCl_4$

333. Which is present in peroxides?
a) O_2 b) O^{2-} c) O_2^{2-} d) O_2^-

334. The number of valency electrons in carbon atom is:
a) Zero b) 2 c) 6 d) 4

335. Which does not form two or more chlorides?
a) NA b) Hg c) Cu d) Fe

336. CCl_4 is insoluble in water because:
a) CCl_4 is non-polar and water is polar
b) Water is non-polar and CCl_4 is polar
c) Water and CCl_4 both are polar
d) None of the above

337. In the transition of Cu to Cu^{2+}, there is a decrease in :
a) Atomic number
b) Atomic mass
c) Equivalent weight
d) Number of valency electrons

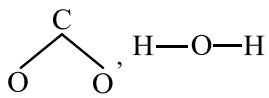
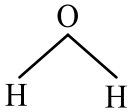
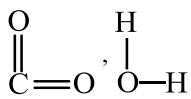
338. In coordinate bond, the acceptor atoms must essentially contain in its valency shell an orbitals:
a) With paired electron b) With single electron c) With no electron d) With three electrons

339. Which one of the following statement is false?
a) The electron affinity of chlorine is less than that of fluorine.
b) The electronegativity of fluorine is more than that of chlorine.
c) The electron affinity of bromine is less than that of chlorine.
d) The electronegativity of chlorine is more than that of bromine.

340. Which of the following halides is most acidic?
a) CCl_4 b) PCl_3 c) $BiCl_3$ d) $SbCl_3$

341. Hybridization state of I in ICl_2^+ is:
a) dsp^2 b) sp c) sp^2 d) sp^3

342. Identify the correct order in which the covalent radius of the following elements increases
(I)Ti (II) Ca (III) Sc
a) (I), (II), (III) b) (III), (II), (I) c) (II), (I), (III) d) (I), (III), (II)

343. Experiment shows that H_2O has a dipole moment whereas, CO_2 has not. Point out the structures which best illustrate these facts:
a) O=C=O, H—O—H
b) 
c) O=C=O, 
d) 

344. Which is chemically most active non-metal?
a) S b) O_2 c) F_2 d) N_2

345. Electron affinity is the
a) Energy released when an electron is added to an isolated atom in the gaseous state
b) Energy absorbed when an electron is added to an isolated atom in the gaseous state

c) Energy required to take out an electron from an isolated gaseous atom
d) Power of an atom to attract an electron to itself

346. Which is paramagnetic?
a) Cl_2O_6 b) Cl_2O_7 c) Cl_2O d) ClO_2

347. The bond length of LiF will be
a) Equal to that of KF
b) More than that of KF
c) Equal to that of NaF
d) Less than that of NaF

348. The bond order of CO molecule on the basis of molecular orbital theory is:
a) Zero b) 2 c) 3 d) 1

349. Compounds formed by sp^3d^2-hybridization will have configuration:
a) Square planar
b) Octahedral
c) Trigonal bipyramidal
d) Pentagonal bipyramidal

350. Ionic radii are:
a) $\propto \frac{1}{\text{effective nuclear charge}}$
b) $\propto \frac{1}{(\text{effective nuclear charge})^2}$
c) $\propto$ effective nuclear charge
d) $\propto (\text{effective nuclear charge})^2$

351. The predominent intermolecular forces in hydrogen fluoride is due to:
a) Dipole-induced dipole interaction
b) Dipole-dipole interaction
c) Hydrogen bond interaction
d) Dispersion interaction

352. Which of the following species does not exist under normal conditions?
a) Be^{2+} b) Be_2 c) B_2 d) Li_2

353. An element with atomic number 21 is a
a) Halogen
b) Representative element
c) Transition element
d) Alkali metal

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

355. Which one of the following oxides is amphoteric in character?
a) SnO_2 b) SiO_2 c) CO_2 d) CaO

356. The correct order in which the first ionisation potential increases is
a) Na, K, Be b) K, Na, Be c) K, Be, Na d) Be, Na, k

357. 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) Cl > F > Br > I b) F > Cl > Br > I c) I > Br > Cl > F d) I > Br > F > Cl

358. As the s-character of hybridization orbitals increases, the bond angle:
a) Increases b) Decreases c) Does not change d) Becomes zero

359. Dipole-dipole attractive forces are strongest between the molecules of:
a) He b) CH_4 c) CO_2 d) H_2O

360. Among Na^+, Na, Mg and Mg^{2+}, the largest particle is
a) Mg^{2+} b) Mg c) Na d) Na^+

361. If the IP of Na is 5.48 eV, the ionisation potential of K will be

a) Same as that of Na b) 4.34 eV c) 5.68 eV d) 10.88 eV

362. The electronic configuration of the atom having maximum difference in first and second ionisation energies is
a) $1s^2, 2s^2, 2p^6, 3s^1$ b) $1s^2, 2s^2, 2p^6, 3s^2$
c) $1s^2, 2s^2, 2p^1$ d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$

363. Amongst $LiCl, RbCl, BeCl_2$ and $MgCl_2$, the compounds with the gratest and the least ionic character respectively are:
a) LiCl and RbCl b) RbCl and $BeCl_2$ c) RbCi and $MgCl_2$ d) $MgCl_2$ and $BeCl_2$

364. Pick the odd man out (The one having zero dipole moment):
a) NH_3 b) H_2O c) BCl_3 d) SO_2

365. The property of attracting electrons by the halogen atoms in a molecule is called
a) Ionisation potential b) Electrons affinity c) Electronegtivity d) Electronic attraction

366. The oxide of an element whose electronic configuration is $1s^2, 2s^2, 2p^6, 3s^1$ is
a) Neutral b) Amphoteric c) Basic d) Acidic

367. Which among the following elements has lowest value of ionisation energy?
a) Mg b) Ca c) Ba d) Sr

368. The pair of elements which on combination are most likely to form an ionic compound is:
a) Na and Ca b) K and O_2 c) O_2 and Cl_2 d) Al and I_2

369. A molecule which cannot exist theoretically is:
a) SF_4 b) OF_2 c) OF_4 d) O_2F_2

370. The ions $O^{2-}, F^-, Na^+, Mg^{2+}$ and $A1^{3+}$ are isoelectronic. Their ionic radii show
a) A decrease from O^{2-} to F^- and then increase from $Na^+$to Al^{3+}
b) A significant increase from $O^{2-}$to Al^{3+}
c) A significant decrease from $O^{2-}$to Al^{3+}
d) An increase from $O^{2-}$to F^- and then decrease from Na^+ to Al^{3+}

371. A sudden large jump between the values of second and third ionisation energies of an element would be associated with the electronic configuration
a) $1s^2, 2s^2, 2p^6, 3s^2$ b) $1s^2, 2s^2, 2p^6, 3s^1$
c) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$ d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$

372. Among O, C, F, Cl, Br the correct order of increasing atomic radii is:
a) $F < O < C < Cl < Br$ b) $F < C < O < Br < Cl$ c) $F < Cl < Br < O < C$ d) $C < O < F < Cl < Br$

373. The correct order of radii is:
a) $N < Be < B$ b) $F^- < O^{2-} < N^{3-}$ c) $Na < Li < K$ d) $Fe^{3+} < Fe^{2+} < Fe^{4+}$

374. The ionic radius of 'Cr' is minimum in which of the following compounds?
a) CrO_2 b) K_2CrO_4 c) CrF_3 d) $CrCl_3$

375. Which molecule has trigonal planar geometry?
a) IF_3 b) PCl_3 c) NH_3 d) BF_3

376. Which is the general outer electronic configuration of the coinage metals?
a) ns^2np^6 b) $(n-1)d^{10}ns^1$ c) $(n-1)d^{10}ns^2$ d) $(n-1)d^9ns^2$

377. Which among the following elements have lowest value of IE_1?
a) Pb b) Sn c) Si d) C

378. The values of electronegativity of atom A and B are 1.20 and 4.0 respectively. The percentage of ionic character of $A-B$ bond is
a) 58.3% b) 48% c) 79.6% d) 73.6%

379. Which of the following element is most electropositive?
a) Al b) Mg c) P d) S

380. Super octet molecule is:
a) F_3Cl b) PCl_3 c) NH_3 d) None of these

381. Which of the following elements will have the lowest first ionisation energy?
a) Li b) Mg c) Ca d) Rb

382. An element X which occurs in the first short period has an outer electronic structure s^2p^1. What are the formula and acid-base character of its oxides?
a) XO_3, basic b) X_2O_3, basic c) X_2O_3, amphoteric d) XO_2, acidic

383. The diamagnetic molecules are:
a) B_2, C_2, N_2 b) O_2, N_2, F_2 c) C_2, N_2, F_2 d) B_2, O_2, N_2

384. Which of the following electronic configuration represents noble gas?
a) ns^2np^6 b) ns^2np^5 c) ns^2np^4 d) ns^2np^3

385. The number of naturally occurring p- block elements that are diamagnetic is
a) 18 b) 6 c) 5 d) 7

386. Which of the following element shows maximum valency?
a) Carbon b) Barium c) Nitrogen d) Sulphur

387. The pair likely to form the strongest hydrogen bonding:
a) H_2O_2 and H_2O
b) HCOOH and CH_3COOH
c) CH_3COOH and CH_3COOCH_3
d) SiH_4 and $SiCl_4$

388. Highest covalent character is found in which of the following?
a) CaF_2 b) $CaCl_2$ c) CaI_2 d) $CaBr_2$

389. How many bridging oxygen atoms are present in P_4O_{10}?
a) 6 b) 4 c) 2 d) 5

390. Which element has the highest electronegativity?
a) C b) O c) Mg d) S

391. Metallic nature and basic nature of the oxides…… as we move along a period
a) Increases b) Decreases
c) Remains constant d) First increases then decreases

392. In which block does 106th element belong?
a) s-block b) p-block c) d-block d) f-block

393. Which of the following is more ionic?
a) NaCl b) KCl c) $MgCl_2$ d) $CaCl_2$

394. Which one of the following orders is not in according with the property stated against it?
a) $F_2 > Cl_2 > Br_2 > I_2$: Electronegativity
b) $F_2 > Cl_2 > Br_2 > I_2$: Bond dissociation energy
c) $F_2 > Cl_2 > Br_2 > I_2$: Oxidising power
d) $HI > HBr > HCl > HF$: Acidic property in water

395. Which one is electron deficient compound?
a) NH_3 b) ICl c) BCl_3 d) PCl_3

396. Which of the following is largest ion?
a) Na^+ b) Mg^{2+} c) O^{2-} d) F^-

397. Which of the following has the minimum bond length?
a) O_2 b) O_2^+ c) O_2^- d) O_2^{2-}

398. Ionisation energy in group 1-A varies in the decreasing order as
a) $Li > Na > K > Cs$ b) $Na > Li > K > Cs$ c) $Li > Cs > K > Na$ d) $K > Cs > Na > Li$

399. Paramagnetism is exhibited by molecules:
a) Not attracted into a magnetic field
b) Containing only paired electrons
c) Carrying a positive charge
d) Containing unpaired electrons

400. The value of bond order in nitrogen and oxygen molecule is:
a) 3, 2 b) 4, 2 c) 2, 3 d) 1, 2

401. In third row of Periodic Table, the atomic radii from Na to Cl

a) Continuously decreases
b) Continuously increases
c) Remains constant
d) Increases but not continuously

402. Which has a giant covalent structure?
a) PbO_2 b) SiO_2 c) NaCl d) $AlCl_3$

403. Which has an odd electron and shows paramagnetic character?
a) NO b) SO_2 c) CO_2 d) H_2O

404. The correct order of increasing bond length of $C-H, C-O, C-C$ and $C=C$ is :
a) $C-H < C-O < C-C < C=C$
b) $C-H < C=C < C-O < C-C$
c) $C-C < C=C < C-O < C-H$
d) $C-O < C-H < C-C < C=C$

405. NF_3 is :
a) Non-polar compound
b) Electrovalent compound
c) Having low value of dipole moment than NH_3
d) Having more dipole moment than NH_3

406. Atomic radii of F and Ne, in Å, are given by
a) 0.72, 0.71 b) 0.72, 1.6 c) 1.6, 1.58 d) 0.71, 0.72

407. When an electron is removed from an atom, its energy
a) Increase b) Decrease c) Remains the same d) None of these

408. In which of the following $p\pi - d\pi$ bonding is observed?
a) NO_3^- b) SO_3^{2-} c) BO_3^{3-} d) CO_3^{2-}

409. In BrF_3 molecule, the lone pair occupy equatorial position to minimize :
a) Lone pair-bond pair repulsion only
b) Bond pair-found pair repulsion only
c) Lone pair-lone pair repulsion and lone pair-bond pair repulsion
d) Lone pair-lone pair repulsion only

410. The number of lone pairs is same in PCl_3 and:
a) BCl_3 b) NCl_3 c) CCl_4 d) PCl_5

411. As a result of resonance:
a) Bond length decreases
b) Energy of the molecules decreases
c) Stability of the molecule increases
d) All are correct

412. The number of ions formed when a molecule of $K_4Fe(CN)_6$ dissociate is:
a) 4 b) 5 c) 6 d) 2

413. Polar covalent compounds are soluble in:
a) Polar solvents b) Non-polar solvents c) Concentrated acids d) All solvents

414. The elements with atomic numbers 9, 17, 35, 53, 85 are all
a) Halogens b) Noble gases c) Heavy metals d) Light metals

415. Which among the following has highest ionic radius?
a) F^- b) B^{3+} c) O^{2-} d) Li^+

416. Strongest bond is formed by the head on overlapping of:
a) $2s$- and 2 p-orbitals b) 2 p- and 2 p-orbitals c) $2s$- and $2s$-orbitals d) All of these

417. $A \rightarrow A^+ + e, E_1$ and $A^+ \rightarrow A^{2+} + e, E_2$. The energy required to pull out the two electrons are E_1 and E_2 respectively. The correct relationship between two energy would be
a) $E_1 < E_2$ b) $E_1 > E_2$ c) $E_1 = E_2$ d) $E_1 \neq E_2$

418. The element having highest electron affinity is
a) Bromine b) Iodine c) Fluorine d) Chlorine

419. Fluorine has low electron affinity than chlorine because of

a) Bigger radius of fluorine, less density
b) Smaller radius of fluorine, high density
c) Smaller radius of chlorine, high density
d) Smaller radius of chlorine, less density

420. The angle between two covalent bonds is maximum in:
a) CH_4 b) H_2O c) CO_2 d) SO_3

421. Which species has lone pair on central atom?
a) CCl_4 b) CH_4 c) NH_4^+ d) H_2O

422. The decreasing order of the second ionization energy of K, Ca and Ba is:
a) $K > Ca > Ba$ b) $Ca > Ba > K$ c) $Ba > K > Ca$ d) $K > Ba > Ca$

423. Which contains both covalent and ionic bonds?
a) CCl_4 b) KCN c) $CaCl_2$ d) H_2O

424. The covalency of nitrogen in HNO_3 is :
a) Zero b) 3 c) 4 d) 5

425. The orbitals of same energy level providing the most efficient overlapping are:
a) $sp^3 - sp^3$ b) $sp - sp$ c) $sp^2 - sp^2$ d) All of these

426. Which of the following has unchanged valency?
a) H b) Na c) Fe d) O

427. The general electronic configuration of the transition elements is
a) $(n-1)d^{10}, (n+1)s^2$ b) $(n-1)d^{1-10}, (n+1)s^{1-2}$
c) $(n-1)d^{1-10}, np^6, ns^2$ d) $(n-1)d^{1-10}, ns^{1-2}$

428. The order of first electron affinity of O, S and Se is:
a) $O > S > Se$ b) $S > O > Se$ c) $Se > O > S$ d) $Se > S > O$

429. Which of the following oxides doesn't react with both of an acid and alkali, is?
a) ZnO b) SnO_2 c) Al_2O_3 d) BeO

430. Which of the following is isoelectronic with carbon atom?
a) Na^+ b) Al^{3+} c) O^{2-} d) N^+

431. The ionic radii of ioselectronic species N^{3-}, $O^{2-}$and $F^-$are in the order?
a) 1.36, 1.40, 1.71 b) 1.36, 1.71, 1.40 c) 1.71, 1.40, 1.36 d) 1.71, 1.36, 1.40

432. Which bond angle, θ would result in the maximum dipole moment for the triatomic molecule XY_2 shown below?
a) $\theta = 90°$ b) $\theta = 120°$ c) $\theta = 150°$ d) $\theta = 180°$

433. The electronegativity values of C, H, O, N and S are 2.5, 2.1, 3.5, 3.0 and 2.5 respectively. Which of the following bonds is most polar?
a) C − H b) N − H c) S − H d) O − H

434. Which of the following sequence correctly represents the decreasing acidic nature of oxides?
a) $Li_2O > BeO > CO_2 > N_2O_3 > B_2O_3$ b) $CO_2 > N_2O_3 > B_2O_3 > LiO > BeO$
c) $N_2O_3 > CO_2 > B_2O_3 > BeO > Li_2O$ d) $CO_2 > BeO > Li_2O > B_2O_3 > N_2O_3$

435. In which o the following compounds, the bonds have the largest percentage of ionic character:
a) H_2O b) HF c) IBr d) N_2O_4

436. Which ion has a higher polarizing power?
a) Mg^{2+} b) Al^{3+} c) Ca^{2+} d) Na^+

437. The first ionisation potential is maximum for
a) B b) N c) O d) Be

438. The highest first ionisation potential is of
a) Carbon b) Boron c) Oxygen d) Nitrogen

439. The ionic radii (Å) of $C^{4-}$and O^{2-} respectively are 2.60 and 1.40. The ionic radius of the isoelectronic ion N^{3-}would be
a) 2.6 b) 1.71 c) 1.4 d) 0.95

440. In a multi-electron atom, the energy of a 2 p-orbital is :
a) Less than that of 2s-orbital
b) More than that of 2s-orbital

c) Equal to that of $2s$-orbital
d) Double that of $2s$-orbital

441. The bond angle in PH_3 is:
a) Much lesser than NH_3
b) Equal to that in NH_3
c) Much greater than in NH_3
d) Slightly more than in NH_3

442. The dipole moment of $CHCl_3$ is 1.05 debye while that of CCl_4 is zero, because CCl_4 is:
a) Linear b) Symmetrical c) Planar d) Regular tetrahedral

443. The high boiling point of water is due to:
a) Weak dissociation of water molecules
b) Hydrogen bonding among water molecules
c) Its high specific heat
d) Its high dielectric constant

444. The number of unpaired electrons in O_2 molecule is:
a) Zero b) 1 c) 2 d) 3

445. Variable valency in general, is exhibited by
a) Transition elements b) Gaseous elements c) Non-metals d) s-block elements

446. Which statement is true?
a) Absolutely pure water does not contain any ion.
b) Some covalent compounds may also give ions in aqueous solution.
c) In aqueous solution only electrovalent compounds give ions.
d) Very sparingly soluble substances do not dissociate in aqueous solution

447. The bond strength increases:
a) With increasing bond order
b) With increasing extent of overlapping of orbitals
c) With decreasing difference between energies of overlapping orbitals
d) All of the above

448. If the ionic radii of K^+ and F^- are about 1.34 Å each, then the expected values of atomic radii of K and F should be respectively:
a) 1.34 and 1.34 Å b) 2.31 and 0.64 Å c) 0.64 and 2.31 Å d) 2.31 and 1.34 Å

449. Which species is paramagnetic?
a) O_2^- b) CH_3^- c) CO d) NO^+

450. Chemical bond formation takes place when:
a) Energy is absorbed
b) Forces of attraction overcome forces of repulsion
c) Forces of repulsion overcome forces of attraction
d) Forces of attraction are equal to forces of repulsion

451. H_2O has a net dipole moment, while BeF_2 has zero dipole moment, because:
a) H_2O molecule as linear while BeF_2 is bent
b) BeF_2 molecule is linear while H_2O is bent
c) Fluorine is more electronegative than oxygen
d) Be is more electronegative than oxygen

452. Which has the smallest size?
a) Na^+ b) Mg^{2+} c) Al^{3+} d) P^{5+}

453. Observe the following statement
VIII. The physical and chemical properties of elements are periodic functions of their electronic configuration.
IX. Electronegativity of fluorine is less than the electronegativity of chlorine.
X. Electropositive nature decreases from top to bottom in a group.

The correct answer is

a) I, II and III are correct
b) Only I is correct
c) Only I and II is correct
d) Only II and III are correct

454. The only non-metal which is liquid at ordinary temperature is

a) Hg
b) Br_2
c) NH_3
d) None of these

455. Which has triangular planar shape?

a) CH_3^+
b) ClO_2^-
c) H_3O^+
d) ClO_3^-

456. With respect to chlorine, hydrogen will be

a) Electropositive
b) Electronegative
c) Neutral
d) None of these

457. In the case of alkali metals, the covalent character decreases in the order:

a) MI > MBr > MCl > MF
b) MCl > MI > MBr > MF
c) MF > MCl > MBr > MI
d) MF > MCl > MI > MBr

458. The set representing the correct order of ionic radius is

a) $Li^+ > Be^{2+} > Na^+ > Mg^{2+}$
b) $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$
c) $Li^{2+} > Na^+ > Mg^{2+} > Be^{2+}$
d) $Mg^{2+} > Be^{2+} > Li^+ > Na^+$

459. Which element has maximum electron affinity?

a) Na
b) Mg
c) Al
d) S

460. Ionisation potential is lowest for

a) Alkali metals
b) Inert gas
c) Halogens
d) Alkaline earth metals

461. It is thought that atoms combine with each other such that the outermost orbit acquires a stable configuration of 8 electrons. If stability were attained with 6 electrons rather than with 8, what would be the formula of the stable fluoride ions?

a) F^{3+}
b) F^+
c) F^-
d) F^{2-}

462. The outermost configuration of the least reactive element is

a) ns^2p^3
b) ns^2p^4
c) ns^2p^5
d) ns^2p^6

463. Elements of the same vertical group of the Periodic Table have

a) Same atomic number
b) Same atomic size
c) Same number of atoms
d) Same number of electrons in outermost shell

464. Ionisation potential for a noble gas is

a) Maximum in a period
b) Minimum in a period
c) Either minimum or maximum
d) Constant

465. Which of the following possess maximum hydration energy?

a) $MgSO_4$
b) $RaSO_4$
c) $SrSO_4$
d) $BaSO_4$

466. The correct order of hybridization of the central atom in the following species NH_3, $[PtCl_4]^{2-}$, PCl_5 and BCl_3 is:

a) dsp^2, dsp^3, sp^2, sp^3
b) sp^3, dsp^2, dsp^3, sp^2
c) dsp^2, sp^2, sp^3, dsp^3
d) dsp^2, sp^3, sp^2, dsp^3

467. Following statements regarding the periodic trends of chemical reactivity to the alkali metals and the halogens are given. Which of these statements gives the correct picture?

a) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group.
b) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group
c) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens.
d) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group.

468. The correct order of ionisation energy of C, N, O, F is

a) $F < O < N < C$ b) $F < N < C < O$ c) $C < N < O < F$ d) $C < O < N < F$

469. Which has minimum ionic radius?
a) N^{3-} b) K^{+} c) Na^{+} d) F^{-}

470. In the isoelectronic species the ionic radii (Å) of N^{3-}, O^{2-} and F^{-} are respectively given by
a) 1.71, 1.40, 1.36 b) 1.71, 1.36, 1.40 c) 1.36, 1.40, 1.71 d) 1.36, 1.71, 1.40

471. The ionisation potential order for which set is correct?
a) $Cs < Li < K$ b) $Cs < Li > B$ c) $Li > K > Cs$ d) $B > Li < K$

472. The correct sequence which shows decreasing order of the ionic radii of the elements is
a) $Al^{3+} > Mg^{2+} > Na^{+} > F^{-} > O^{2-}$ b) $Na^{+} > Mg^{2+} > Al^{3+} > O^{2-} > F^{-}$
c) $Na^{+} > F^{-} > Mg^{2+} > O^{2-} > Al^{3+}$ d) $O^{2} > F^{-} > Na^{+} > Mg^{2+} > Al^{3+}$

473. Among HX, the maximum dipole moment is of:
a) HF b) HCl c) HBr d) HI

474. Compound formed by sp^3d-hybridization will have structure:
a) Trigonal bipyramidal
b) T-shaped
c) Linear
d) Either of these depending on number of lone pair of electrons of central atom

475. The energy change accompanying the process given below is,
$Na^{+}(g) + Cl^{-}(g) \rightarrow NaCl(s)$
a) Hydration energy b) Ionization energy c) Electron affinity d) Lattice energy

476. Ice has an open structure compared to water due to which it floats on water and occupies a greater volume of space. The open structure of ice is due to:
a) Solid state of ice b) Its low density c) Crystalline nature d) Hydrogen bonding

477. The electrons in an incomplete outershell are known as :
a) Kernel electrons b) Valency electrons c) Shell electrons d) None of the above

478. Which of the following is not a correct statement?
a) Every AB_5 molecule does in fact have square pyramid structure
b) Multiple bonds are always shorter than corresponding single bonds
c) The electron-deficient molecules can act as Lewis acids
d) The canonical structures have no real existence

479. Van der Waals' forces are applied to:
a) Inert gases only
b) Rare gases only
c) Mixture of gases
d) Elementary gases only

480. The correct order of dipole moment is:
a) $CH_4 < NF_3 < NH_3 < H_2O$
b) $NF_3 < CH_4 < NH_3 < H_2O$
c) $NH_3 < NF_3 < CH_4 < H_2O$
d) $H_2O < NH_3 < NF_3 < CH_4$

481. Which of the following species contains three bond pairs and one lone pair around the central atom?
a) NH_2^- b) PCl_3 c) H_2O d) BF_3

482. In H_2^- ion, the bond order is:
a) Zero b) $1/2$ c) $-1/2$ d) 1

483. Which statement is correct?
a) Pi-bond always exists with sigma-bond
b) Pi-bond can exist independently
c) Sigma-bond is weaker than pi-bond
d) Pi-bond is less reactive than sigma-bond

484. Which is highest melting point halide?

a) NaCl b) NaBr c) NaF d) NaI

485. The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order:
K_2CO_3 (I) $MgCO_3$ (II)
$CaCO_3$ (III) $BeCO_3$ (IV)
a) I < II < III < IV b) IV < II < III < I c) IV < II < I < III d) II < IV < III < I

486. Elements of which group form anions most readily?
a) Halogens b) Alkali metals c) Oxygen family d) Nitrogen group

487. The bond order of C_2^+ is:
a) 1 b) 2 c) 3/2 d) 1/2

488. Which is not a scale of measuring electronegativity?
a) Stevenson's scale b) Mulliken's scale
c) Allred-Rochow's scale d) Pauling scale

489. In the series ethane, ethylene and acetylene, the C − H bond energy is :
a) The same in all the three compounds
b) Greatest in ethane
c) Greatest in ethylene
d) Greatest in acetylene

490. Which ion is not isoelectronic with O^{2-}?
a) N^{3-} b) Na^+ c) F^- d) Ti^+

491. The ionic radii of N^{3-}, O^{2-} and F^- are respectively given by:
a) 1.36, 1.40, 1.71 b) 1.36, 1.71, 1.40 c) 1.71, 1.40, 1.36 d) 1.71, 1.36, 1.40

492. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals?
a) π^* orbital b) π orbital c) σ^* orbital d) σ orbital

493. Which of the following has largest size?
a) Al b) Al^+ c) Al^{2+} d) Al^{3+}

494. The correct order of increasing bond angles in the following species is:
a) $Cl_2O < ClO_2 < ClO_2^-$ b) $ClO_2 < Cl_2O < ClO_2^-$ c) $Cl_2O < ClO_2^- < ClO_2$ d) $ClO_2^- < Cl_2O < ClO_2$

495. In the Periodic Table metallic character of elements shows one of the following trend
a) Decreases down the group and increases across the period
b) Increases down the group and decreases across the period
c) Increases across the period and also down the group
d) Decreases across the period and also down the group

496. When sodium and chlorine react, energy is:
a) Released and ionic bond is formed
b) Released and covalent bond is formed
c) Absorbed and covalent bond is formed
d) Absorbed and ionic bond is formed

497. In third row of Periodic Table from Na to Cl
a) Electronegativity increases b) Electronegativity decreases
c) Ionisation energy decreases d) Atomic volume increases

498. The molecule having smallest bond angle is:
a) $AsCl_3$ b) $SbCl_3$ c) PCl_3 d) NCl_3

499. Which of the following statements regarding carbon monoxide is correct?
a) It involves *sp*-orbitals of carbon
b) It contains a lone pair only on carbon
c) It contains a lone pair only on oxygen
d) It carbonyl, oxygen end is attached to the metal atoms

500. The hydration of ionic compounds involves:
a) Evolution of heat

b) Weakening of attractive forces
c) Dissociation into ions
d) All of the above

501. Ionic radii are
a) Inversely proportional to effective nuclear charge
b) Inversely proportional to square of effective nuclear charge
c) Directly proportional to effective nuclear charge
d) Directly proportional to square of effective nuclear charge

502. Which of the following is the atomic number of a metal?
a) 32 b) 34 c) 36 d) 38

503. The electronic configurations of four elements are given below. Arrange these elements in the correct order of the magnitude (without sign) of their electron affinity.
XI. $2s^2 2p^5$
XII. $3s^2 3p^5$
XIII. $2s^2 2p^4$
XIV. $3s^2 3p^4$
Select the correct answer using the codes given below
a) (i) < (ii)<(iv)<(iii) b) (ii)<(i)<(iv)<(iii) c) (i)<(iii)<(iv)<(ii) d) (iii)<(iv)<(i)<(ii)

504. Which statement is correct?
a) X^+ ion is larger than X^- ion
b) X^- ion is larger in size than X atom
c) X^+ and X^- have the same size
d) X^+ ion is larger in size than X atom

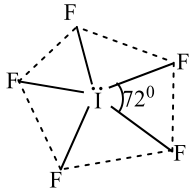
505. The correct order of size of iodine species is
a) $I > I^- > I^+$ b) $I^- > I > I^+$ c) $I^+ > I > I^-$ d) $I^- > I^+ > I$

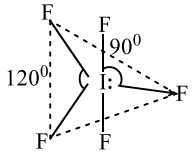
506. Which of the following statement is wrong?
a) The stability of hydrides increase from NH_3 to BiH_3 in group 15 of the periodic table.
b) Nitrogen cannot form $d\pi - p\pi$ bond.
c) Single N—N bond is weaker than the single P—P bond
d) N_2O_4 has two resonance structure

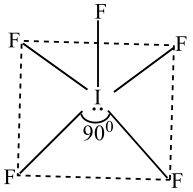
507. Methanol and ethanol are miscible in water due to:
a) Covalent character
b) Hydrogen bonding character
c) Oxygen bonding character
d) None of the above

508. Bond order of N_2^- anion is :
a) 3.0 b) 2.0 c) 2.5 d) 1.5

509. Among the following, the number of elements showing only one non-zero oxidation state is
O, Cl, F, N, P, Sn, Tl, Na, Ti
a) 1 b) 2 c) 3 d) 4

510. The structure of IF_5 can be best demonstrated as:
a) 

b) 

c) 

d) None of these

511. The correct decreasing order of first ionisation enthalpies of five elements of the second period is
a) Be > B > C > N > F b) N > F > C > B > Be c) F > N > C > Be > B d) N > F > B > C > Be

512. The correct order of second ionisation potential of carbon, nitrogen, oxygen and fluorine is:
a) C > N > O > F b) O > N > F > C c) O > F > N > C d) F > O > N > C

513. Of the following elements, which one has the highest electronegativity?
a) F b) Cl c) Br d) I

514. A molecule in which sp^2-hybrid orbitals are used by the central atom in forming covalent bond is:
a) He_2 b) SO_2 c) PCl_5 d) N_2

515. The hydrogen bonding is strongest in:
a) $O-H\cdots S$ b) $S-H\cdots O$ c) $F-H\cdots F$ d) $F-H\cdots O$

516. In which of the following process energy is liberated?
a) $Cl \rightarrow Cl^+ + e$ b) $HCl \rightarrow H^+ + Cl^-$ c) $Cl + e \rightarrow Cl^-$ d) $O^- + e \rightarrow O^{2-}$

517. A covalent bond is formed between the atoms by the overlapping of orbitals containing:
a) Single electron
b) Paired electron
c) Single electron with parallel spin
d) Single electron with opposite spin

518. Which main group elements have a different number of outermost electrons than their group number?
a) Alkali metals b) Noble gases c) Halogens d) None of these

519. Which one of the following has the highest electronegativity?
a) Br b) Cl c) P d) Si

520. If the ionization potential for hydrogen atom is 13.6 eV, then the ionization potential for He^+ ion should be:
a) 72.2 eV b) 54.4 eV c) 6.8 eV d) 13.6 eV

521. Which property is commonly exhibited by a covalent compound?
a) High solubility in water
b) Low m. p.
c) High electrical conductivity
d) High b. p.

522. The energy of antibonding molecular orbitals is:
a) Greater than the bonding M. O.
b) Smaller than the bonding M. O.
c) Equal to that of bonding M. O.
d) None of the above

523. Which is not characteristic of π-bond?
a) π-bond is formed when a sigma bond already formed
b) π-bond is formed from hybrid orbitals
c) π-bond may be formed by the overlapping of p-orbitals
d) π-bond results from lateral overlap of atomic orbitals

524. An atom with atomic number 20 is most likely to combine chemically with the atom whose atomic number is:
a) 11 b) 16 c) 18 d) 10

525. How does the ionisation energy of 1st group elements vary?
a) Increases down the group b) Decreases down the group
c) Remains unchanged d) Variation is not regular

526. Which one of the following pairs is isostructural ($i.e.$, having the same shape and hybridization)?
a) [NF_3 and BF_3] b) [BF_4^- and NH_4^+] c) [BCl_3 and $BrCl_3$] d) [NH_3 and NO_3^-]

527. Which shows the highest lattice energy?
a) RbF b) CsF c) NaF d) KF

528. The hybridization of phosphorus in $POCl_3$ is same as in:
a) P in PCl_3 b) S in SF_6 c) Cl and ClF_3 d) B in BCl_3

529. Which does not have pyramidal geometry?
a) SO_3^{2-} b) NO_3^- c) NH_3 d) $C(C_6H_5)_3^-$

530. Dative bond is present in:

a) SO_3 b) NH_3 c) $BaCl_2$ d) BF_3

531. Amongst H_2O, H_2S, H_2Se and H_2Te, the one with highest boiling point is:
   a) H_2O because of hydrogen bonding
   b) H_2Te because of higher molecular weight
   c) H_2S because of hydrogen bonding
   d) H_2Se because of lower molecular weight
532. Which of the following halides is least stable and has doubtful existence?
   a) CI_4 b) GeI_4 c) SnI_4 d) PbI_4
533. Which property of halogens increases from F to I?
   a) Electronegativity
   b) First ionisation energy
   c) Bond length in the molecule
   d) None of the above
534. Which has highest melting point?
   a) LiCl b) $BeCl_2$ c) BCl_3 d) CCl_4
535. Which of the following phenomenon will occur when two atoms of an element with same spin of electron in orbitals approach each other?
   a) Orbitals will overlap
   b) Orbitals will not overlap
   c) Bonding will take place
   d) A diatomic molecule will be formed
536. The least stable ion among the following is
   a) Li^- b) Be^- c) B^- d) C^-
537. The electron affinity values for the halogens show the following trend
   a) $F < Cl > Br > I$ b) $F < Cl < Br < I$ c) $F > Cl > Br > I$ d) $F < Cl > Br < I$
538. CO_2 has the same geometry as:
   $(A)HgCl_2, (B)NO_2, (C)SnCl_4, (D)C_2H_2$
   a) A and C b) B and D c) A and D d) C and D
539. In which of the following molecule, the central atom does not have sp^3-hybridization?
   a) CH_4 b) SF_4 c) BF_4^- d) NH_4^+
540. The elements present in the core of earth are collectively known as
   a) Lithophiles b) Nucleophiles c) Chalcophiles d) Siderophiles
541. In the Modern Periodic Table, elements are arranged
   a) Alphabetically b) With increasing volume
   c) With increasing mass d) With increasing atomic number
542. Which of the ions has the largest ionic radius?
   a) Be^{2+} b) Mg^{2+} c) Ca^{2+} d) Sr^{2+}
543. The elements having the electronic configuration [Kr] $4d^{10}f^{14}, 5s^2p^6d^2, 6s^2$ belongs to
   a) s-block b) p-block c) d-block d) f-block
544. Some of the properties of the two species, NO_3^- and H_3O^+ are described below. Which one of them is correct?
   a) Dissimilar in hybridization for the central atom with different structure
   b) Isostructural with same hybridization for the central atom
   c) Isostructural with different hybridization for the central atom
   d) Similar is hybridization for the central atom with different structure
545. Which compound shows hydrogen bonding?
   a) HCl b) C_2H_6 c) RCH_2CHO d) RCH_2NHCH_3
546. The ionization potential order for which set is correct?
   a) $Li > K > Cs$ b) $B > Li > K$ c) $Cs > Li > B$ d) $Cs < Li < K$
547. Which shows non-directional bonding?

a) BCl_3 b) CsCl c) NCl_3 d) $BeCl_3$

548. Maximum number of covalent bonds between two like atoms can be:
a) Three b) Two c) Four d) One

549. *o*-hydroxy benzaldehyde, although contains enolic group but does not give test of group with $FeCl_3$ because:
a) It is steam volatile
b) Of intermolecular H-bonding
c) Of intermolecular H-bonding
d) All of the above

550. Bond energy of covalent $O-H$ bond in water is :
a) Greater than bond energy of hydrogen bond
b) Equal to bond energy of hydrogen bond
c) Less than bond energy of hydrogen bond
d) None of the above

551. Which is expected to show paramagnetism?
a) ClO_2 b) SO_2 c) CO_2 d) SiO_2

552. Which pair has both members from the same period of Periodic Table?
a) Cl, Br b) Ca, Cl c) Na, Ca d) Na, Cl

553. In which of the following arrangements, the sequence is not strictly according to the property written against it?
a) $HF < HCl < HBr < HI$: increasing acid strength
b) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing basic strength
c) $B < C < O < N$: increasing first ionization enthalpy
d) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidizing power

554. The half of the difference between the number of electrons in bonding molecular orbitals and antibonding molecular orbitals is known as:
a) Bond order b) Proton order c) Molecular order d) Electron order

555. Which can be described as a molecule with residual bonding capacity?
a) N_2 b) CH_4 c) NACl d) $BeCl_2$

556. The intermolecular attractive forces vary in the order:
a) water < alcohol < ether
b) water > alcohol > ether
c) alcohol > water < ether
d) ether > water > alcohol

557. Which have zero dipole moment?
a) 1, 1-dichloroethene
b) *Cis*-1, 2-dichloroethene
c) *Trans*-1, 2-dichlorothene
d) None of the above

558. When ionic compounds get dissolved in water:
a) They involve heat changes
b) Inter-ionic attraction is reduced
c) Ions show dipole-ion attraction with water molecules
d) All are correct

559. H_2O boils at higher temperature than H_2S because it is capable of forming:
a) Ionic bonds b) Covalent bonds c) Hydrogen bonds d) Metallic bonds

560. Which one of the following elements has the highest ionisation energy?
a) $[Ne]3s^2 3p^1$ b) $[Ne]3s^2 3p^3$ c) $[Ne]3s^2 3p^2$ d) $[Ar]\ 3d^{10}, 4s^2 4p^2$

561. Which element exist as a solid at 25°C and 1 atm pressure among the following?
a) Br b) Cl c) Hg d) P

562. In allene structure, three carbon atoms are joined by:
   a) Three σ-and three π-bonds
   b) Two σ-and one π-bond
   c) Two σ-and two π-bonds
   d) Three π-bonds only
563. Among the following statement, the correct statement about PH_3 and NH_3 is:
   a) NH_3 is a better electron donor because the lone pair of electron occupies spherical s-orbital and is less directional
   b) PH_3 is a better electron donor because the lone pair of electron occupies sp^3-orbital and is more directional
   c) NH_3 is a better electron donor because the lone pair of electron occupies sp^3-orbital and more directional
   d) PH_3 is a better electron donor because the lone pair of electron occupies spherical s-orbital and is less directional
564. Which of the following pairs show reverse properties on moving along a period from left to right and from top to down in a group?
   a) Nuclear charge and electron affinity
   b) Ionisation radius and electron affinity
   c) Atomic radius and electron affinity
   d) None of the above
565. Covalent radius of Li is 123 pm. The crystal radius of Li will be:
   a) > 123 pm
   b) < 123 pm
   c) $+123$ pm
   d) $= \frac{123}{2}$ pm
566. Bond length decreases with:
   a) Decrease in size of the atom
   b) Increase in the number of bonds between the atoms
   c) Decrease in bond order
   d) Decrease in the number of bonds between the atoms
567. Which of the following statements is most correct?
   Effective nuclear charge of an atom depends on:
   a) The atomic number of the atom
   b) The charge on the ion
   c) The shielding effect
   d) Both the actual nuclear charge and the shielding effect
568. Which of the following oxides is most basic?
   a) Na_2O
   b) SiO_2
   c) SO_2
   d) All are equally basic
569. Which one of the following ions has the highest value of ionic radius?
   a) Li^+
   b) B^{3+}
   c) O^{2-}
   d) F^-
570. Which has the lowest bond angle?
   a) NH_3
   b) BeF_2
   c) H_3O^+
   d) CH_4
571. Pauling's electronegativity values for elements are useful in predicting
   a) Polarity of bonds in molecules
   b) Position of elements in electromotive series
   c) Coordination number
   d) Dipole moment of various molecules
572. The correct order of decreasing polarisability of ion is:
   a) Cl^-, Br^-, I^-, F^-
   b) F^-, I^-, Br^-, Cl^-
   c) I^-, Br^-, Cl^-, F^-
   d) F^-, Cl^-, Br^-, I^-
573. Strongest oxidising agent among halogen is
   a) I_2
   b) Br_2
   c) Cl_2
   d) F_2
574. Which contains a coordinate and covalent bond?
   a) $BaCl_2$
   b) NH_4Cl
   c) HCl
   d) H_2O
575. Which of the following acts sometimes as a metal and sometimes as a non-metal?

a) Hg b) Cl c) K d) At

576. The lowest ionization energy would be associated with the electronic structure:
a) $1s^2, 2s^2\ 2p^6, 3s^1$ b) $1s^2, 2s^2 2p^5$ c) $1s^2, 2s^2 2p^6$ d) $1s^2, 2s^2 2p^6, 3s^2$

577. IP is influenced by:
a) Size of atom
b) Charge on nucleus
c) Electrons present in inner shells
d) All of the above

578. The bond between chlorine and bromine in $BrCl_3$ is:
a) Ionic
b) Non-polar
c) Polar with negative end on Br^-
d) Polar with negative end on Cl^-

579. The hydration energy of Mg^{2+} is larger than that of:
a) Al^{3+} b) Na^+ c) Be^{2+} d) None of these

580. Which of the following characteristics regarding halogens is not correct?
a) Ionization energy decreases with increase in atomic number.
b) Electronegativity decreases with increase in atomic number.
c) Electron affinity decreases with increase in atomic number.
d) Enthalpy of fusion increases with increase in atomic number.

581. IP_2 for an element is invariably higher than IP_1 because :
a) The size of cation is smaller than its atom
b) It is difficult to remove $'e'$ from cation
c) Effective nuclear charge is more for cation
d) All of the above

582. Which of the following is correct?
a) Decreases in bond length means increase in bond strength
b) Covalent radius of carbon is less than that of nitrogen
c) Single bonds are stronger than double bonds
d) Fe (III) chloride cannot exist in the dimeric form Fe_2Cl_6

583. Molecular orbitals theory was proposed by:
a) Werner b) Kossel c) Moseley d) Mullikan

584. Proton plays an important role in … bonding .
a) Electrovalent b) Hydrogen c) Covalent d) Coordinate

585. Which cannot exist on the basis of M. O. theory?
a) C_2 b) He_2^+ c) H_2^+ d) He_2

586. Which of the following statement is correct?
a) Polarization of an anion is maximum by high charged cation
b) Small sized cation minimises the polarisation
c) A small anion brings about a large degree of polarization
d) A small anion undergoes a high degree of polarization

587. The double bonds between the two carbon atoms in ethylene consists of:
a) Two sigma-bonds at right angles to each other.
b) One sigma-bond and one pi-bond
c) Two pi-bonds at right angles to each other
d) Two pi-bonds at an angle of 60° to each other

588. Which compound among the following has more covalent character?
a) $AlCl_3$ b) AlI_3 c) MgI_2 d) NaI

589. Iron is tougher than sodium because:
a) Iron atom is smaller

b) Iron atoms are more closely packed
c) Metallic bonds are stronger in iron
d) None of the above

590. In HCHO carbon atom has hybridisation:
a) sp b) sp^2 c) sp^3 d) None of these

591. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?
a) Ne$[3s^2 3\,p^1]$ b) Ne$[3s^2 3\,p^3]$ c) Ne$[3s^2 3\,p^2]$ d) Ar$[3d^{10} 4s^2 4\,p^3]$

592. In which pair, the first atom or ion is not larger than the second?
a) N, F b) Cl^-, Cl c) O, S d) Fe^{2+}, Fe^{3+}

593. The correct order of ionic radii is:
a) $Fe > Fe^{2+} > Fe^{3+}$ b) $O^{2-} > O^- > O^+$ c) $I^- > I > I^+$ d) All of these

594. Greater the dipole moment:
a) Grater is the ionic nature
b) Lesser the polarity
c) Smaller the ionic nature
d) None of these

595. The element with the electronic configuration as [Ar]$3d^{10}4s^2 4p^3$ represents a
a) Metal b) Non-metal c) Metalloid d) Transition element

596. Bonded electron pairs present in octahedral SF_6 molecule:
a) 3 b) 4 c) 6 d) 5

597. First ionisation energy is highest for
a) Noble gases b) Platinum metals
c) Transition elements d) Inner-transition elements

598. According to the Periodic Law of elements, the variation in properties of elements is related to their
a) Atomic masses b) Nuclear masses
c) Atomic masses d) Nuclear neutron-proton number ratios

599. The angle between the overlapping of one s-orbital and one p-orbital is:
a) 180° b) 120° c) 109°28′ d) 120°60′

600. The ionisation energy will be maximum for the process:
a) $Ba \rightarrow Ba^{2+}$ b) $Be \rightarrow Be^{2+}$ c) $Cs \rightarrow Cs^+$ d) $Li \rightarrow Li^+$

601. Ionization energy of nitrogen is more than oxygen because:
a) Nucleus has more attraction for electrons
b) Half-filled p-orbitals are more stable
c) Nitrogen atom is small
d) More penetration effect

602. One would expect the elemental form of Cs at room temperature to be:
a) A network solid b) A metallic solid c) Non-polar liquid d) An ionic liquid

603. The carbon atom in graphite is:
a) sp^2-hybridized b) sp^3- hybridized c) sp-hybridized d) None of these

604. Which involves a bond forming process?
a) Stretching rubber
b) Dissolution of sugar in water
c) Rusting of iron
d) Emission of γ-rays by radioactive iron

605. Which element has highest electronegativity?
a) F b) He c) Ne d) Na

606. The trivalent ion having largest size in lanthanide series is
a) Ti b) Zr c) Hf d) La

607. PF_3 molecule is:

a) Square planar b) Trigonal bipyramidal c) Tetrahedral d) Trigonal pyramidal

608. When an element of very low ionisation potential is allowed to react with an element of very high electron affinity, we get:
a) A weak ionic bond b) A strong ionic bond c) A polar covalent bond d) No bond

609. Which of the following is an amphoteric oxide?
a) SO_3 b) MgO c) Al_2O_3 d) P_4O_{10}

610. In which element shielding effect is not possible?
a) H b) Be c) B d) N

611. One mole of magnesium in the vapour state absorbed 1200 $kJmol^{-1}$ of energy. If the first and second ionisation energies of Mg are 750 and 1450 $kJmol^{-1}$ respectively, the final composition of the mixture is
a) $31\%Mg^{+} + 69\%Mg^{2+}$ b) $69\%Mg^{+} + 31\%Mg^{2+}$
c) $86\%Mg^{+} + 14\%Mg^{2+}$ d) $14\%Mg^{+} + 86\%Mg^{2+}$

612. The $Cl - C - Cl$ angle in 1, 1, 2, 2-tetrachloroethene and tetrachloromethane respectively will be about:
a) 109.5° and 900° b) 120° and 109.5° c) 90° and 109.5° d) 109.5° and 120°

613. In which of the following pairs bond angle is 109°28′?
a) $[NH_4^+], [BF_4^-]$ b) $[NH_4^+], [BF_3]$ c) $[NH_3], [BF_4^-]$ d) $[NH_3], [BF_3]$

614. Polarization of electrons in acrolein may be written as:
a) $\overset{\delta-}{C}H_2 = CH - \overset{\delta+}{C}H = O$ b) $\overset{\delta-}{C}H_2 = CH - CH = \overset{\delta+}{O}$ c) $\overset{\delta-}{C}H_2 = \overset{\delta+}{C}H - CH = O$ d) $\overset{\delta+}{C}H_2 = CH - CH = \overset{\delta-}{O}$

615. Molecular shape of SF_4, CF_4 and XeF_4 are:
a) The same with 2, 0 and 1 lone pair of electrons respectively
b) The same with 1, 1 and 1 lone pair of electrons respectively
c) Different with 0, 1 and 2 lone pairs of electrons respectively
d) Different with 1, 0 and 2 lone pairs of electrons respectively

616. Which one is the weakest bond?
a) Hydrogen b) Ionic c) Covalent d) Metallic

617. Which has the lowest anion to cation size ration?
a) LiF b) NaF c) CsI d) CsF

618. Which set has strongest tendency to form anions?
a) Ga, In, Te b) Na, Mg, Al c) N, O, F d) V, Cr, Mn

619. Which one is most polar?
a) CCl_4 b) $CHCl_3$ c) CH_3Cl d) CH_3OH

620. Acetate ion contains:
a) One C, O single bond and one C, O double bond
b) Two C, O single bonds
c) Two C, O double bonds
d) None of the above

621. The nodal plane in the π-bond of ethane is located in:
a) The molecular plane
b) A plane parallel to the molecular plane
c) A plane perpendicular to the molecular plane which bisects the carbon-carbon σ-bond at right angle
d) A plane perpendicular to the molecular plane which contains the carbon-carbon σ-bond

622. Which of the following isoelectronic ions has lowest ionisation energy?
a) Cl^- b) Ca^{2+} c) K^+ d) S^{2-}

623. The electronegativity difference between N and F is greater than that between N and H yet the dipole moment of NH_3 (1.5 D) is larger than that of NF_3 (0.2 D). this is because:
a) In NH_3 as well as NF_3 the atomic dipole and bond dipole are in opposite directions.
b) In NH_3 the atomic dipole and bond dipole are in the opposite directions whereas in NF_3 these are in the same direction.
c) In NH_3 as well as in NF_3 the atomic dipole and bond dipole are in the same direction.

d) In NH_3 the atomic dipole and bond dipole are in the same direction whereas in NF_3 these are in opposite directions.

624. In the electronic structure of acetic acid there are:
a) 16 shared and 8 unshared valency electrons
b) 8 shared and 16 unshared valency electrons
c) 12 shared and 12 unshared valency electrons
d) 18 shared and 6 unshared valency electrons

625. Van der Waals' forces between molecules depend upon:
a) Number of electrons b) Charge on nucleus c) Radius of atoms d) All of these

626. IP_1 and IP_2 of Mg are 178 and 348 kcal mol^{-1}. The energy required for the reaction, $Mg \rightarrow Mg^{2+} + 2e^-$ is:
a) $+170$ kcal b) $+526$ kcal c) -170 kcal d) -526 kcal

627. Among NaF, NaCl, NaBr and NaI, the NaF has highest melting point because :
a) It has maximum ionic character
b) It has minimum ionic character
c) It has associated molecules
d) It has least molecular weight

628. Which does not show hydrogen bonding?
a) C_2H_5OH b) Liquid NH_3 c) H_2O d) Liquid HBr

629. A trend common to both group I and VII elements in the Periodic Table as atomic number increases is
a) Atomic radius increases b) Oxidising power increases
c) Reactivity with water increases d) Maximum valency increases

630. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas?
a) London dispersion force
b) Hydrogen bonding
c) Dipole-dipole interaction
d) Covalent bond

631. Which among the following elements has lowest value of ionisation energy?
a) Pb b) Sn c) Si d) C

632. Which of the atomic number pairs represents elements of s-block?
a) 7, 15 b) 5, 12 c) 9, 17 d) 3, 12

633. The correct order of decreasing first ionisation energy is
a) $C > B > Be > Li$ b) $C > Be > B > Li$ c) $B > C > Be > Li$ d) $Be > Li > B > C$

634. The total number of bonds in acetylene molecules is:
a) One b) Two c) Three d) Five

635. The elements X, Y, Z and T have the indicated electronic configuration. Starting with the innermost shell, which is the most metallic element?
a) $X = 2, 8, 4$ b) $Y = 2, 8, 8$ c) $Z = 2, 8, 8, 1$ d) $T = 2, 8, 8, 7$

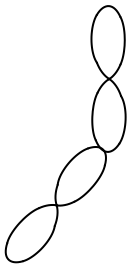
636. Maximum covalence of an atom of an element is equal to:
a) Number of unpaired electrons in the s-and p-orbitals of valency shell
b) Number of unpaired electrons in the p-orbitals of valency shell
c) Total number of electrons in the s-and p-orbitals of valency shell
d) Total number of electrons in the p-orbitals of valency shell

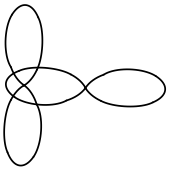
637. How many unpaired electrons are present in N_2^+?
a) 1 b) 2 c) 3 d) 4

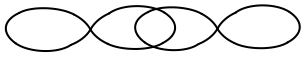
638. Which of the following has shortest carbon-carbon bond length?
a) C_6H_6 b) C_2H_6 c) C_2H_4 d) C_2H_2

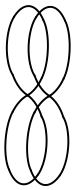
639. Which of the following is largest?
a) Cl^- b) S^{2-} c) Na^+ d) F^-

640. Which p-orbitals overlapping would give the strongest bond?

a) 

b) 

c) 

d) 

641. $H-O-H$ bond angle in H_2O is 104.5° and not 109°28′ because of:
   a) High electronegativity of oxygen
   b) Bond pair-bond pair repulsion
   c) Lone pair-lone pair repulsion
   d) Lone pair –bond pair repulsion

642. Which of the following statements is wrong?
   a) The stability of hydrides increases from NH_3 to BiH_3 in group 15 of the Periodic Table.
   b) Nitrogen cannot from $d\pi - p\pi$ bond.
   c) Single $N-N$ bond is weaker than the single $P-P$ bond.
   d) N_2O_4 has two resonance structure.

643. The ratio of σ and π-bonds in benzene is:
   a) 2 b) 6 c) 4 d) 8

644. In which one of the following species, the central atom has the type of hybridization which is not the same as that present in other three?
   a) SF_4 b) I_3^- c) $SbCl_5^{2-}$ d) PCl_5

645. Which is correct order for electron gain enthalpy?
   a) $S < O < Cl < F$ b) $O < S < F < Cl$ c) $Cl < F < S < O$ d) $F < Cl < O < S$

646. The first ionisation energy of lithium will be
   a) Greater than Be b) Less than Be c) Equal to that of Na d) Equal to that of F

647. When two atomic orbitals combine, they form:
   a) One molecular orbitals
   b) Two molecular orbitals
   c) Two bonding molecular orbitals
   d) Two antibonding molecular orbitals

648. The set representing the correct order of first ionisation energy is
   a) $K > Na > Li$ b) $Be > Mg > Ca$ c) $B > C > N$ d) $Ge > Si > C$

649. The electronic configuration of the element with maximum electron affinity is
   a) $1s^2, 2s^2, 2p^3$ b) $1s^2, 2s^2, 2p^5$ c) $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$ d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$

650. Which of the following has regular tetrahedral shape?
   a) $[Ni(CN)_4]^{2-}$ b) SF_4 c) $[BF_4]^-$ d) XeF_4

651. The smallest among the following ions is

a) Na^+ b) Mg^{2+} c) Ba^{2+} d) Al^{3+}

652. Coordinate compounds are formed by:
   a) Transfer of electrons
   b) Sharing of electrons
   c) Donation of electron pair
   d) None of the above

653. The statement that is true for the long form of the Periodic Table is
   a) It reflects the sequence of filling the electrons in the order of sub-energy levels s, p, d and f
   b) It helps to predit the stable valency states of the elements
   c) If reflects trends in physical and chemical properties of the elements
   d) All of the above

654. Which of the following elements never show positive oxidation number?
   a) O b) Fe c) Ga d) F

655. The energy released when a neutral gaseous atom takes up an electron is called:
   a) Ionization energy b) Solvation energy c) Electronegativity d) Electron affinity

656. The structure of XeF_4 is:
   a) Planar b) Tetrahedral c) Square planar d) Pyramidal

657. Which one of the following is expected to have largest size?
   a) F^- b) O^{2-} c) N^{3-} d) Al^{3+}

658. Debye an unit of dipole moment is of the order of:
   a) 10^{-10} esu cm b) 10^{-18} esu cm c) 10^{-6} esu cm d) 10^{-12} esu cm

659. Among LiCl, $BeCl_2$, BCl_3 and CCl_4, the covalent bond character follows the order:
   a) $LiCl > BeCl_2 > BCl_3 > CCl_4$
   b) $LiCl < BeCl_2 < BCl_3 < CCl_4$
   c) $LiCl > BeCl_2 > CCl_4 > BCl_3$
   d) $LiCl < BeCl_2 < BCl_3 > CCl_4$

660. Which one of the following elements has lower value of ionisation energy?
   a) Mg b) Rb c) Li d) Ca

661. Identify the least stable ion amongst the following:
   a) Li^- b) Be^- c) B^- d) C^-

662. For the type of interactions: (I) Covalent bond, (II) van der Waals' forces, (III) Hydrogen bonding, (IV) Dipole-dipole interaction, which represents the correct order of increasing stability?
   a) (I) < (III) < (II) < (IV)
   b) (II) < (III) < (IV) < (I)
   c) (II) < (IV) < (III) < (I)
   d) (IV) < (II) < (III) < (I)

663. According to Fajan's rule polarization is more when:
   a) Small cation and large anion
   b) Small cation and small anion
   c) Large cation and large anion
   d) Large cation and small anion

664. Which is correct about ionisation potential?
   a) It is independent of atomic radii
   b) It increases with increase in atomic radii
   c) It remains constant with increase in atomic radii
   d) It decreases with increase in atomic radii

665. A sudden large jump between the value of first and second ionisation energies of elements would be associated with which of the following electronic configurations?
   a) $1s^2, 2s^2 2p^6, 3s^1$ b) $1s^2, 2s^2 2p^6, 3s^2 3p^1$ c) $1s^2, 2s^2, 2p^6, 3s^1 3p^2$ d) $1s^2, 2s^2 2p^6, 3s^2$

666. The pair of amphoteric hydroxides is

a) $LiOH, Al(OH)_3$ b) $Be(OH)_2, Mg(OH)_2$ c) $B(OH)_2, Be(OH)_2$ d) $Be(OH)_2, Zn(OH)_2$

667. Which one has more tendency to form covalent compounds?
a) Ba b) Be c) Mg d) Ca

668. The electron affinity for inert gases is likely to be:
a) High b) Small c) Zero d) Positive

669. Increasing order (lower first) of size of the various hybridised orbitals is:
a) sp, sp^2, sp^3 b) sp^3, sp^2, sp c) sp^2, sp^3, sp d) sp^2, sp, sp^3

670. Shape of molecules is decided by:
a) Sigma bond
b) π-bond
c) Both sigma and π-bonds
d) Neither sigma nor π-bonds

671. Which statement is wrong?
a) Hybridization is the mixing of atomic orbitals prior to their combining into molecular orbitals
b) sp^2-hybrid orbitals are formed from two p-atomic orbitals and one s-atomic orbitals
c) dsp^2- hybrid orbitals are all at 90° to one another
d) d^2sp^3-hybrid orbitals are directed towards the corners of a regular tetrahedron

672. Which one of the following has maximum ionisation potential?
a) K b) Be c) Na d) Mg

673. In OF_2, number of bond pairs and lone pairs of electrons are respectively:
a) 2, 6 b) 2, 8 c) 2, 10 d) 2, 9

674. Which is the correct order of electronegativity?
a) $F > N < O > C$ b) $F > N > O > C$ c) $F > N > O < C$ d) $F < N < O = C$

675. Which of the following has maximum bond energy?
a) Cl_2 b) F_2 c) Br_2 d) I_2

676. In which molecule sulphur atom is not sp^3-hybridized?
a) SO_4^{2-} b) SF_4 c) SF_2 d) None of these

677. Hydrogen fluoride is a liquid unlike other hydrogen halides because:
a) HF molecules associate due to hydrogen bonding
b) F_2 is highly reactive
c) HF is the weakest acid of all hydrogen halides
d) Fluorine atom is the smallest of all halogens

678. The $O-H$ bond distance in water molecule is:
a) 1.0 Å b) 1.33 Å c) 0.96 Å d) 1.45 Å

679. Van der Waals' forces are maximum in:
a) HBr b) LiBr c) LiCl d) AgBr

680. The increasing order of the ionic radii of the given isoelectronic species is:
a) $S^{2-}, Cl^-, Ca^{2+}, K^+$ b) $Ca^{2+}, K^+, Cl^-, S^{2-}$ c) $K^+, S^{2-}, Ca^{2+}, Cl^-$ d) $Cl^-, Ca^{2+}, K^+, S^{2-}$

681. Which of the following exhibits diamagnetic behavior:
a) NO b) O_2^{2-} c) O_2^+ d) O_2

682. The electronic configuration of sodium and chlorine justifies:
a) Their physical state
b) Their reactivity
c) The formation of electrovalent compound NaCl
d) None of the above

683. Identify the correct order of solubility of Na_2S, CuS and ZnS in aqueous medium:
a) $Cus > ZnS > Na_2S$ b) $ZnS > Na_2S > CuS$ c) $Na_2S > CuS > ZnS$ d) $Na_2S > ZnS > CuS$

684. The correct order of radii is
a) $N < Be < B$ b) $F^- < O^{2-} < N^{3-}$ c) $Na < Li < K$ d) $Fe^{3+} < Fe^{2+} < Fe^{4+}$

685. The compound showing maximum covalent character is:

a) BI_3 b) BCl_3 c) BF_3 d) BBr_3

686. The nature of bonding in CCl_4 and CaH_2:
   a) Electrovalent in both CCl_4 and CaH_2
   b) Covalent in CCl_4 and electrovalent in CaH_2
   c) Electrovalent in CCl_4 and covalent in CaH_2
   d) None of the above

687. In which of the following pairs the two species are not isostructural?
   a) PCl_4^+ and $SiCl_4$ b) PF_5 and BrF_5 c) AlF_6^{3-} and SF_6 d) CO_3^{2-} and NO_3^-

688. The pair of species having identical shape of both species:
   a) BF_3, PCl_3 b) PF_5, IF_5 c) CF_4, SF_4 d) XeF_2, CO_2

689. Which of the following halogen acids is least basic?
   a) HF b) HCl c) HBr d) HI

690. Beryllium shows diagonal relationship with
   a) Mg b) Na c) B d) Al

691. The compound with the maximum dipole moment among the following is:
   a) p-dichlorobenzene b) m-dichlorobenzene c) o-dichlorobenzene d) Carbon tetrachloride

692. Which of the following molecules is covalent and shows expanded octet in its formation?
   a) HF b) NF_3 c) BF_3 d) ClF_3

693. Correct order of first ionisation potential among the following elements Be, B, C, N, O is
   a) $B < Be < C < O < N$ b) $B < Be < C < N < O$ c) $Be < B < C < N < O$ d) $Be < B < C < O < N$

694. For making good quality mirrors, plates of float glass are used. These are obtained by floating molten glass over a liquid metal which does not solidify before glass. The metal used can be
   a) Mercury b) Tin c) Sodium d) Magnesium

695. Which of the following pairs has both members of the same period of the Periodic Table?
   a) $Na - Cl$ b) $Na - Ca$ c) $Ca - Cl$ d) $Cl - Br$

696. The increasing order of the first ionization enthalpies of the elements B, P, S and F (lower first) is:
   a) $F < S < P < B$ b) $P < S < B < F$ c) $B < P < S < F$ d) $B < S < P < F$

697. Which of the following element has higher ionisation energy?
   a) Boron b) Carbon c) Oxygen d) Nitrogen

698. The correct order of acidic strength
   a) $Cl_2O_7 > SO_2 > P_4O_{10}$ b) $K_2O > CaO > MgO$
   c) $CO_2 > N_2O_5 > SO_3$ d) $Na_2O > MgO > Al_2O_3$

699. Which of the following element is metalloid?
   a) Bi b) Sn c) Ge d) C

700. The number of lone pairs of electron on Xe in $XeOF_4$ is:
   a) 1 b) 2 c) 3 d) 4

701. Which of the following metals exhibits more than one oxidation state?
   a) Na b) Mg c) Al d) Fe

702. Among the following which has the highest cation to anion size ratio?
   a) CsI b) CsF c) LiF d) NaF

703. The correct order of ionic radius is
   a) $Ti^{4+} < Mn^{7+}$ b) $^{35}Cl^- > ^{37}Cl^-$ c) $K^+ > Cl^-$ d) $P^{3+} > P^{5+}$

704. An electrovalent compound does not exhibit space isomerism due to:
   a) Presence of ions
   b) High melting point
   c) Strong electrostatic forces between constituent ions
   d) Non-directional nature of electrovalent bond

705. The element with the lowest ionisation potential is
   a) Na b) K c) Rb d) Cs

706. Which has the largest distance between the carbon hydrogen atom?

a) Ethane b) Ethene c) Ethyne d) Benzene

707. Which one pair of atoms or ions will have same configuration?
a) Li^+ and He^- b) Cl^- and Ar c) Na and K d) F^+ and Ne

708. Atoms or group of atoms which are electrically charged are known as:
a) Anions b) Cations c) Ions d) Atoms

709. The element with atomic number 36 belongs to …block in the Periodic Table.
a) p b) s c) f d) d

710. Which bond is more polar?
a) $Cl - Cl$ b) $N - F$ c) $C - F$ d) $O - F$

711. If the electronegativity difference between two atoms A and B is 2.0, then the percentage of covalent character in the molecule is
a) 54% b) 46% c) 23% d) 72%

712. In the following, the element with the highest ionisation energy is
a) $[Ne]3s^2 3p^1$ b) $[Ne]3s^2 3p^3$ c) $[Ne]3s^2 3p^2$ d) $[Ne]3s^2 3p^4$

713. Ionization potential is lowest for:
a) Halogens b) Inert gases c) Alkaline earth metals d) Alkali metals

714. Electron affinity is positive, when
a) O changes into O^- b) O^- changes into O^{2-}
c) O changes into O^+ d) Electron affinity is always negative

715. A bond with maximum covalent character between non-metallic elements is formed:
a) Between identical atoms
b) Between chemically similar atoms
c) Between atoms of widely different electro-negativities
d) Between atoms of the same size

716. A sp^3-hybrid orbital contains :
a) 1/4 s-character b) 1/2 s-character c) 2/3 s-character d) 3/4 s-character

717. In a crystal, the atoms are located at the positions of:
a) Maximum potential energy
b) Minimum potential energy
c) Zero potential energy
d) Infinite potential energy

718. Water has high heat of vaporization due to:
a) Covalent bonding b) H-bonding c) Ionic bonding d) None of the above

719. The IP_1, IP_2, IP_3, IP_4, and IP_5 of an element are $7.1, 14.3, 34.5, 46.8, 162.2, eV$ respectively. The element is likely to be:
a) Na b) Si c) F d) Ca

720. Stability of hydrides generally increases with:
a) Increase in bond angle
b) Decrease in bond angle
c) Decrease in resonance
d) None of these

721. The radii of F, F^-, O and O^{2-} are in the order of:
a) $O^{2-} > F^- > F > O$ b) $F^- > O^{2-} > F > O$ c) $O^{2-} > O > F^- > F$ d) $O^{2-} > F^- > O > F$

722. Which one is the strongest bond?
a) $Cl - F$ b) $F - F$ c) $Br - F$ d) $Br - Cl$

723. The low solubility of $BaSO_4$ in water is due to:
a) Low dissociation energy
b) Ionic bonds
c) High value of lattice energy
d) None of the above

724. The metal having highest melting point is?
a) Cr b) Ag c) Diamond d) W
725. Which one species has the longest bond length?
a) NO^+ b) O_2^- c) O_2^+ d) N_2^+
726. Arrange the following compound in order of increasing dipole moment:
Toluene (I) $m-$ dichlorobenzene (II)
$o-$ dichlorobenzene (III) $p-$ dichlorobenzene (IV)
a) I < IV < II < III b) IV < I < II < III c) IV < I < III < II d) IV < II < I < III
727. The correct order regarding the electronegativity of hybrid orbitals of carbon is:
a) $sp < sp^2 > sp^3$ b) $sp < sp^2 < sp^3$ c) $sp > sp^2 < sp^3$ d) $sp > sp^2 > sp^3$
728. Molecular size of ICl and Br_2 is nearly same, but boiling point of ICl is about 40°C higher than Br_2. This might be due to:
a) I − Cl bond is stronger than Br − Br bond
b) Ionisation energy of I < ionisation energy of Br
c) ICl is polar where as Br_2 is non-polar
d) The size of I > size of Br
729. The pair of elements having approximately equal ionisation potential is
a) Al, Ga b) Al, Si c) Al, Mg d) Al, B
730. Elements having six electrons in its outermost orbit generally form:
a) Complex ion b) Negative ion c) Positive ion d) Zwitter ion
731. In which of the following molecules/ions BF_3, NO_2^-, NH_2^-, and H_2O the central atom is sp^2 hybridized?
a) BF_3 and NO_2^- b) NO_2^- and NH_2^- c) NH_2^- and H_2O d) NO_2^- and H_2O
732. Na^+, Mg^{2+}, Al^{3+}, Si^{4+} are isoelectronics. Their ionic size follows the order:
a) $Na^+ < Mg^{2+} < Al^{3+} < Si^{4+}$
b) $Na^+ > Mg^{2+} < Al^{3+} < Si^{4+}$
c) $Na^+ < Mg^{2+} > Al^{3+} > Si^{4+}$
d) $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$
733. Which of the following is false?
a) Methane molecule is tetrahedral in shape
b) Nickel tetrachloride is square planar in shape
c) P_2O_5 is like two pyramids joined at their apices
d) Acetylene is non-linear
734. In a double bond connecting two atoms there is a sharing of:
a) 2 electrons b) 4 electrons c) 1 electron d) All electrons
735. As we go from left to right in period two of the Periodic Table, gram atomic volume of the elements
a) Will change indefinitely b) Decreases
c) Increases at a constant rate d) First increases then decreases
736. Which of the following bond requires the largest amount of energy to dissociate the bond concerned?
a) H − H bond in H_2 b) C − H bond in CH_4 c) N ≡ N bond in N_2 d) O = O bond in O_2
737. Which does not show inert pair effect?
a) Al b) Sn c) Pb d) Thallium
738. Resonance is due to:
a) Delocalization of σ-electrons
b) Delocalization of π-electrons
c) Migration of H atoms
d) Migration of protons
739. The ICl molecule is:
a) Purely covalent
b) Purely electrovalent
c) Polar with negative end on chlorine

d) Polar with negative end on iodine

740. $H-B-H$ bond angle in BH_4^- is:
a) $180°$ b) $120°$ c) $109°$ d) $90°$

741. The lowest bond energy exist in the following bonds for:
a) $C-C$ b) $N-N$ c) $H-H$ d) $O-O$

742. Which of the following electronic configurations in the outermost shell is characteristic of alkali metals?
a) $ns^2p^6d^1$ b) $(n-1)s^2p^6, ns^1$ c) $(n-1)s^2p^6, ns^2p^1$ d) $(n-1)s^2p^6d^{10}, ns^1$

743. In PCl_5 molecule, P is:
a) sp^3-hybridized b) dsp^2-hybridized c) ds^3p-hybridized d) sp^3d-hybridized

744. In dry ice there are … in between molecules.
a) Ionic bond b) Covalent bond c) Hydrogen bond d) None of these

745. The solubility of KCl is relatively more in (where D is dielectric constant):
a) $C_6H_6(D=0)$ b) $(CH_3)_2CO(D=2)$ c) $CH_3OH(D=32)$ d) $CCl_4(D=0)$

746. The I^{st} IEs of four consecutive elements present in the second period of Periodic Table are 8.3, 11.3, 14.5 and 13.6 eV respectively. Which of these is the IE of nitrogen?
a) 13.6 b) 8.3 c) 14.5 d) 11.3

747. Which oxide is amphoteric in nature?
a) ZnO b) CaO c) Na_2O d) BaO

748. The correct ionic radii order is:
a) $N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$
b) $N^{3-} > Na^+ > O^{2-} > F^- > Mg^{2+} > Al^{3+}$
c) $Na^+ > O^{2-} > N^{3-} > F^- > Mg^{2+} > Al^{3+}$
d) $O^{2-} > F^- > Na^+ > N^{3-} > Mg^{2+} > Al^{3+}$

749. Which is a good solvent for ionic and polar covalent compounds?
a) H_2O b) CH_3COOH c) CCl_4 d) Liquid NH_3

750. For which of the following hybridization the bond angle is maximum?
a) sp^2 b) sp c) sp^3 d) dsp^2

751. Which of the following does not involve covalent bond?
a) PH_3 b) CsF c) HCl d) H_2S

752. The correct increasing covalent nature is:
a) $NACl < LiCl < BeCl_2$ b) $BeCl_2 < NaCl < LiCl$ c) $BeCl_2 < LiCl < NaCl$ d) $LiCl < NaCl < BeCl_2$

753. The bond between atoms of two elements of atomic number 37 and 53 is:
a) Covalent b) Ionic c) Coordinate d) Metallic

754. The species having octahedral shape is:
a) SF_6 b) BF_4^- c) PCl_5 d) BO_3^{3-}

755. Which of the following is not isoelectronic?
a) NO^- b) CN^- c) N_2 d) O_2^{2+}

756. In which of the following gaseous molecules, the ionic character of the covalent bond is greatest?
a) HCl b) HBr c) HI d) HF

757. What bond order does O_2^{2-} have?
a) 1 b) 2 c) 3 d) 1/2

758. Chlorine atom differs from chloride ion in the number of:
a) Protons b) Neutrons c) Electrons d) Protons and electrons

759. Which molecule is T-shaped?
a) BeF_2 b) BCl_3 c) NH_3 d) ClF_3

760. The successive ionisation energy values for an element 'X' are given below
XV. Ist ionisation energy $=410$ kJ mol^{-1}
XVI. 2nd ionisation energy $=820$ kJ mol^{-1}
XVII. 3rd ionisation energy $=1100$ kJ mol^{-1}
XVIII. 4th ionisation energy $=1500$ kJ mol^{-1}

XIX. 5th ionisation energy $=3200$ kJ mol^{-1}

Find out the number of valence electron for the atom 'X'

a) 4 b) 3 c) 5 d) 2

761. Organic compounds soluble in water contain:

a) C, H, Cl b) C, H c) C, H, O d) C, S

762. Which of the following is most stable?

a) Pb^{2+} b) Ge^{2+} c) Si^{2+} d) Sn^{2+}

763. Which of the following sets represents the collection of isoelectronic species?

a) $Na^+, Mg^{2+}, Al^{3+}, Cl^-$ b) $Na^+, Ca^{2+}, Sc^{3+}, F^-$ c) $K^+, Cl^-, Mg^{2+}, Sc^{3+}$ d) $K^+, Ca^{2+}, Sc^{3+}, Cl^-$

764. Which one of the following sets of ions represents a collection of isoelectronic species?

a) $K^+, Cl^-, Ca^{2+}, Sc^{3+}$ b) $Ba^{2+}, Sr^{2+}, K^+, Ca^{2+}$ c) $N^{3-}, O^{2-}, F^-, S^{2-}$ d) $Li^+, Na^+, Mg^{2+}, Ca^{2+}$

765. Which one of the following arrangements represents the correct order of electron gain enthalpy (with negative sign) of the given atomic species?

a) $Cl < F < S < O$ b) $O < S < F < Cl$ c) $S < O < Cl < F$ d) $F < Cl < O < S$

766. Which of the following molecules does not possess a permanent electric dipole moment?

a) H_2S b) SO_2 c) SO_3 d) CS_2

767. Which one of the following has the highest electronegativity?

a) Si b) P c) Cl d) Br

768. The electronic configuration, $1s^2, 2s^2 2p^6, 3s^2\ 3p^6 3d^9$ represents a

a) Metal atom b) Non-metal atom c) Non-metallic anion d) Metallic cation

769. The bond order in O_2^+ is equal to bond order in:

a) N_2^+ b) CN^- c) CO d) NO^+

770. The molecule having permanent dipole moment is:

a) SF_4 b) XeF_4 c) SiF_4 d) BF_3

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

CHEMISTRY

: ANSWER KEY :

1)	d	2)	c	3)	b	4)	b	173)	c	174)	b	175)	d	176)	c
5)	b	6)	b	7)	d	8)	a	177)	a	178)	c	179)	d	180)	b
9)	c	10)	b	11)	c	12)	d	181)	c	182)	d	183)	a	184)	a
13)	d	14)	c	15)	b	16)	b	185)	d	186)	b	187)	c	188)	a
17)	d	18)	d	19)	d	20)	a	189)	a	190)	d	191)	d	192)	a
21)	c	22)	b	23)	b	24)	c	193)	a	194)	a	195)	a	196)	a
25)	b	26)	c	27)	a	28)	c	197)	c	198)	a	199)	c	200)	d
29)	c	30)	c	31)	b	32)	b	201)	b	202)	b	203)	c	204)	b
33)	b	34)	a	35)	c	36)	a	205)	a	206)	c	207)	a	208)	b
37)	c	38)	a	39)	c	40)	a	209)	c	210)	a	211)	c	212)	a
41)	b	42)	a	43)	c	44)	c	213)	a	214)	a	215)	c	216)	a
45)	b	46)	a	47)	d	48)	b	217)	b	218)	c	219)	a	220)	c
49)	c	50)	c	51)	a	52)	c	221)	a	222)	c	223)	b	224)	b
53)	c	54)	d	55)	b	56)	b	225)	b	226)	c	227)	c	228)	c
57)	a	58)	b	59)	c	60)	c	229)	d	230)	c	231)	a	232)	c
61)	d	62)	c	63)	b	64)	d	233)	b	234)	a	235)	b	236)	d
65)	d	66)	a	67)	d	68)	d	237)	c	238)	b	239)	a	240)	d
69)	c	70)	d	71)	d	72)	b	241)	d	242)	a	243)	a	244)	d
73)	a	74)	a	75)	a	76)	b	245)	d	246)	d	247)	b	248)	b
77)	c	78)	b	79)	b	80)	d	249)	b	250)	a	251)	c	252)	b
81)	d	82)	a	83)	d	84)	d	253)	c	254)	a	255)	b	256)	b
85)	b	86)	b	87)	d	88)	c	257)	d	258)	d	259)	d	260)	c
89)	a	90)	a	91)	c	92)	c	261)	c	262)	c	263)	c	264)	d
93)	b	94)	c	95)	b	96)	b	265)	c	266)	d	267)	a	268)	d
97)	a	98)	a	99)	c	100)	c	269)	a	270)	d	271)	d	272)	a
101)	d	102)	d	103)	c	104)	b	273)	d	274)	a	275)	d	276)	b
105)	c	106)	b	107)	b	108)	b	277)	d	278)	a	279)	b	280)	d
109)	b	110)	d	111)	d	112)	c	281)	d	282)	a	283)	c	284)	d
113)	c	114)	a	115)	a	116)	a	285)	c	286)	a	287)	c	288)	d
117)	b	118)	d	119)	d	120)	d	289)	c	290)	a	291)	b	292)	c
121)	c	122)	b	123)	a	124)	b	293)	d	294)	b	295)	b	296)	a
125)	c	126)	d	127)	c	128)	d	297)	c	298)	d	299)	c	300)	a
129)	a	130)	b	131)	a	132)	c	301)	d	302)	c	303)	a	304)	a
133)	d	134)	c	135)	b	136)	a	305)	d	306)	a	307)	d	308)	b
137)	b	138)	b	139)	d	140)	c	309)	a	310)	c	311)	b	312)	b
141)	d	142)	c	143)	a	144)	b	313)	a	314)	a	315)	d	316)	b
145)	a	146)	d	147)	c	148)	a	317)	c	318)	a	319)	b	320)	b
149)	c	150)	b	151)	a	152)	c	321)	b	322)	c	323)	a	324)	d
153)	d	154)	c	155)	a	156)	c	325)	a	326)	a	327)	b	328)	b
157)	c	158)	c	159)	d	160)	a	329)	c	330)	b	331)	c	332)	c
161)	b	162)	b	163)	b	164)	a	333)	c	334)	d	335)	a	336)	a
165)	a	166)	b	167)	b	168)	a	337)	d	338)	c	339)	a	340)	b
169)	a	170)	c	171)	b	172)	d	341)	d	342)	d	343)	c	344)	c

345)	a	346)	d	347)	d	348)	c	549)	c	550)	a	551)	a	552)	d
349)	b	350)	a	351)	c	352)	b	553)	b	554)	a	555)	d	556)	b
353)	c	354)	a	355)	a	356)	b	557)	c	558)	d	559)	c	560)	b
357)	a	358)	a	359)	d	360)	c	561)	d	562)	c	563)	c	564)	c
361)	b	362)	a	363)	b	364)	c	565)	a	566)	b	567)	d	568)	a
365)	c	366)	c	367)	c	368)	b	569)	c	570)	a	571)	a	572)	c
369)	c	370)	c	371)	a	372)	a	573)	d	574)	b	575)	d	576)	a
373)	b	374)	b	375)	d	376)	b	577)	d	578)	d	579)	b	580)	c
377)	b	378)	d	379)	b	380)	a	581)	d	582)	a	583)	d	584)	d
381)	d	382)	c	383)	c	384)	a	585)	d	586)	a	587)	b	588)	b
385)	c	386)	d	387)	b	388)	c	589)	c	590)	b	591)	b	592)	c
389)	a	390)	b	391)	b	392)	c	593)	d	594)	a	595)	c	596)	c
393)	b	394)	b	395)	c	396)	c	597)	a	598)	c	599)	a	600)	b
397)	b	398)	a	399)	d	400)	a	601)	b	602)	b	603)	a	604)	c
401)	a	402)	b	403)	a	404)	b	605)	a	606)	d	607)	d	608)	b
405)	c	406)	b	407)	a	408)	b	609)	c	610)	a	611)	b	612)	b
409)	c	410)	b	411)	d	412)	b	613)	a	614)	d	615)	d	616)	a
413)	a	414)	a	415)	c	416)	b	617)	d	618)	c	619)	d	620)	a
417)	a	418)	d	419)	b	420)	c	621)	a	622)	d	623)	d	624)	a
421)	d	422)	a	423)	b	424)	c	625)	d	626)	b	627)	a	628)	d
425)	b	426)	b	427)	d	428)	b	629)	a	630)	b	631)	b	632)	d
429)	d	430)	d	431)	c	432)	a	633)	b	634)	d	635)	c	636)	c
433)	d	434)	c	435)	b	436)	b	637)	a	638)	d	639)	b	640)	c
437)	b	438)	d	439)	b	440)	b	641)	c	642)	a	643)	c	644)	c
441)	a	442)	d	443)	b	444)	c	645)	b	646)	b	647)	b	648)	b
445)	a	446)	b	447)	d	448)	b	649)	c	650)	c	651)	d	652)	c
449)	a	450)	b	451)	b	452)	d	653)	c	654)	d	655)	d	656)	c
453)	b	454)	b	455)	a	456)	a	657)	c	658)	b	659)	b	660)	b
457)	a	458)	b	459)	d	460)	a	661)	b	662)	b	663)	a	664)	d
461)	b	462)	d	463)	d	464)	a	665)	a	666)	d	667)	b	668)	c
465)	a	466)	b	467)	d	468)	d	669)	a	670)	a	671)	d	672)	b
469)	c	470)	a	471)	c	472)	d	673)	b	674)	a	675)	a	676)	b
473)	a	474)	d	475)	d	476)	d	677)	a	678)	c	679)	d	680)	b
477)	b	478)	a	479)	c	480)	a	681)	b	682)	c	683)	d	684)	b
481)	b	482)	b	483)	a	484)	c	685)	c	686)	b	687)	b	688)	d
485)	b	486)	a	487)	c	488)	a	689)	d	690)	d	691)	c	692)	d
489)	d	490)	d	491)	c	492)	a	693)	a	694)	d	695)	a	696)	d
493)	a	494)	d	495)	b	496)	a	697)	d	698)	a	699)	c	700)	a
497)	a	498)	a	499)	a	500)	d	701)	d	702)	b	703)	d	704)	d
501)	a	502)	d	503)	d	504)	b	705)	d	706)	a	707)	b	708)	c
505)	b	506)	a	507)	b	508)	c	709)	a	710)	c	711)	b	712)	b
509)	b	510)	c	511)	c	512)	c	713)	d	714)	b	715)	a	716)	a
513)	a	514)	b	515)	c	516)	c	717)	b	718)	b	719)	b	720)	a
517)	d	518)	b	519)	b	520)	b	721)	d	722)	c	723)	c	724)	d
521)	b	522)	a	523)	b	524)	b	725)	b	726)	b	727)	d	728)	c
525)	b	526)	b	527)	c	528)	a	729)	a	730)	b	731)	a	732)	d
529)	b	530)	a	531)	a	532)	d	733)	d	734)	b	735)	b	736)	c
533)	c	534)	a	535)	b	536)	b	737)	a	738)	b	739)	c	740)	c
537)	a	538)	c	539)	b	540)	d	741)	d	742)	b	743)	d	744)	b
541)	d	542)	d	543)	c	544)	a	745)	c	746)	c	747)	a	748)	a
545)	d	546)	b	547)	b	548)	a	749)	a	750)	b	751)	b	752)	a

753)	**b**	**754)**	**a**	**755)**	**a**	**756)**	**d**	**765)**	**b**	**766)**	**d**	**767)**	**c**	**768)**	**d**
757)	**a**	**758)**	**c**	**759)**	**d**	**760)**	**a**	**769)**	**a**	**770)**	**a**				
761)	**c**	**762)**	**a**	**763)**	**d**	**764)**	**a**								

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

CHEMISTRY

: HINTS AND SOLUTIONS :

1 **(d)**
Born-Haber cycle inter-relates the various energy terms involved in ionic bonding.

2 **(c)**
Follow bonding rules.

3 **(b)**
Alkali metals are most electropositive elements.

4 **(b)**
In H_2O, H-atom contains only two electrons.

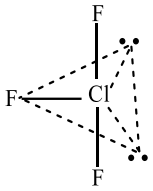
5 **(b)**
Fluorine is more reactive than chlorine, bromine and iodine

6 **(b)**
Due to H-bonding in NH_3.

7 **(d)**
The order of screening effect for a given shell electrons is $s > p > d > f$.

8 **(a)**
The ionisation energy of elements decreases down the group.

9 **(c)**
Cl in ClF_3 has sp^3d-hybridization



and possesses two axial Cl— F bonds and one equatorial bond Two lone pairs are at equatorial position give rise to bent 'T' shape to ClF_3.

10 **(b)**
In like atoms, electronegativity difference is zero.

11 **(c)**
S_2 molecule is paramagnetic like O_2 having 2 unpaired electrons.

13 **(d)**
Along the period acidic strength of oxide increases

14 **(c)**
In order to belong with the same family, the outer configuration must be the same

15 **(b)**
Mn^{2+} is most stable as it has half filled d-orbitals.

16 **(b)**
The atomic radius decreases along the period. Also cations are always smaller than their parent atom and anions are always larger than their parent atom .

17 **(d)**
$S = C = S$.

18 **(d)**
Cation radius increases down the group.

19 **(d)**
Cyanide ion is,
$-\bar{C} \equiv N \rightarrow -\bar{N} \rightleftarrows C$.

20 **(a)**
All are isoelectronic species; more is nuclear charge smaller is ionic size.

21 **(c)**
Electron affinity order for halogens is $Cl > F > Br > I$.

22 **(b)**
N atom has smallest radius.

23 **(b)**
Halogens (ns^2np^5) after getting one electron occupy ns^2np^6 configuration, thus have EA_2 zero

24 **(c)**
In general, density increases on moving downward in a group but density of potassium (K) is lesser than that of the sodium (Na). This is because of the abnormal increase in atomic size on moving from Na (86 pm) to K (227 pm).
Thus, the correct order of density is
$Li < K < Na < Rb$

25 **(b)**
The oxide having maximum heat of formation per oxygen atom (thus energy needed to break one $M - O$ bond will be highest) will be most stable. MgO is most stable oxide among Na_2O, SiO_2, Al_2O_3 and MgO.

26 **(c)**
If Aufbau rule is not followed then 19th electron in K enters in $3d$ sub-shell, not in $4s$

27 **(a)**

The most electronegative element is F and next to F is O.

28 **(c)**

Larger is the size of atom, lesser is the tendency for overlapping, lesser is bond energy.

29 **(c)**

Bond angles in $BeCl_2$, NH_3, H_2O and $SnCl_2$ are 180°, 107°, 104.5° and 119° respectively. Also H_2S, H_2O, H_2Se has sp^3-hybridization and bond angles of hydrides decreases down the group.

30 **(c)**

The correct increasing basic strength:

$SbH_3 < AsH_3 < PH_3 < NH_3$

$NH_3$is the most basic because of its small size, the electron density of electron pair is concentrated over small region. As the size increases, the electron density gets diffused over a large surface area and hence the ability to donate the electron pair (basicity) decreases.

31 **(b)**

Each period consists of a series of elements whose atoms have the same principal quantum number (n) of the outermost shell, ie, in second period, $n = 2$, this shell has four orbitals (one $2s$ and three $2p$) which can have eight electrons, hence second period contain 8 elements from atomic number 3 to 10

32 **(b)**

Om moving along a period, ionisation enthalpy increases. Thus, the order of ionisation enthalpy should be as follow :

$$F > O > N$$

But N has half-filled structure, therefore, it is more stable than O, That's why its ionisation erthalpy is highper than O. Thus, the correct order of IE is

$$F > O > N$$

33 **(b)**

This give rise to polarity in bonds.

34 **(a)**

BeO is most acidic in nature amongst the given choices because acidity of oxides increases with decreases in electropositive character of central atom.

35 **(c)**

NaCl exist as Na^+Cl^-.

36 **(a)**

NH_3 has pyramidal shape and thus, possesses three folds axis of symmetry.

37 **(c)**

Larger is the difference in electronegativities of two atom, more is polar character in bond.

38 **(a)**

Non-polar or pure covalent bond has zero per cent ionic character due to the absence of partial charges on either end.

39 **(c)**

N in it has three σ-bonds and one lone pair of electron.

40 **(a)**

Mendeleef failed to assign positions to isotopes on the basis of atomic mass according to his periodic law

41 **(b)**

The removal of second electron from Mg takes place from $3s$-orbital whereas, the removal of second electron from Na takes place from $2p$-orbital. More closer are shells to the nucleus, difficult is removal of electron.

42 **(a)**

ZnO can react with acid and base both

$ZnO + 2HCl \quad ZnCl_2 + H_2O$

$ZnO + 2NaOH \quad Na_2ZnO_2 + H_2O$

43 **(c)**

ClO_4^- has sp^3-hybridization on Cl atom .

44 **(c)**

O_2 has two unpaired electrons .

45 **(b)**

$O^{-2}$and N^{3-} both are isoelectronic but differ in the charge possessed by them. As the negative charge increase, the electrons are held less and less tightly by the nucleus, therefore ionic radii increases. Hence, ionic radii of N^{3-} is greater than O^{2-}.

In a period from left to right atomic radii decreases but in a group on moving downwards it increases.

46 **(a)**

Ne has van der Waals radius larger than covalent radius of fluorine.

48 **(b)**

The value of electron affinity decreases with increase in size of atom, because the nuclear attraction decreases as the atomic number increases. Fluorine due to its very small size has lower electron affinity than chlorine. Hence, the increasing order of electron affinity of halogen is

$$I < Br < F < Cl.$$

49 **(c)**

The element is P which exists as P_4.

50 **(c)**
Atomic size of Ag and Au are closer to each other but nuclear charge is more on Au

51 **(a)**
S atom is larger in size than O and F.

52 **(c)**
Electropositive character decreases across the period as metallic character decreases

53 **(c)**
Due to shielding effect of $(n-1)d$-subshell.

54 **(d)**
Non-metals are more than metals is the wrong statement.

55 **(b)**
$1s^2, 2s^2, 2p^6, 3s^1$. It is an alkali metal; hence has least ionisation potential.

56 **(b)**
The ionisation potential decreases down the group.

58 **(b)**
N is sp^2-hybridized on NO_3^-.

59 **(c)**
$e.g.$, BF_3, a non-polar molecule having sp^2-hybridization.

60 **(c)**
Butadiene is $CH_2 = CH - CH = CH_2$.

61 **(d)**
$M^{2+} \rightarrow M^{3+}$, after the removal of $2e^-$, the nuclear charge per electron increases due to which high energy is required to remove $3e^-$

62 **(c)**
O_2^- has one unpaired electron in its antibonding molecular orbital.

63 **(b)**
Removal of electron is easier in the order of shell $4 > 3 > 2 > 1$

64 **(d)**
Ionic radii increases in a group

65 **(d)**
Ionic compounds conduct current only in fused state.

66 **(a)**
The bond orders for H_2, H_2^+, He_2 and He_2^+ are 1.0, 0.5, 0.0 and 0.5 respcetively.

67 **(d)**
CH_3^+ and NH_2^+ both have 8 electrons .

69 **(c)**
O atom possesses sp^3-hybridization with two lone pair of electron.

70 **(d)**
$Be_2C + 2H_2O \rightarrow CH_4 + 2BeO$

$Al_4C_3 + 6H_2O \rightarrow 3CH_4 + 2Al_2O_3$

71 **(d)**
H_2O is V shaped.

72 **(b)**
NH_4^+ has angle of 109°28′.

73 **(a)**
Due to sp^3-hybridization on P with one lone pair.

74 **(a)**
In MnO_4^-, the oxidation no. of Mn is $+7$, $i.e.$, all the $4s$ and $3d$ electrons are lost.

75 **(a)**
If difference in electronegativity in between two atoms is 1.7, the molecule possesses 50% covalent +50% ionic nature.

76 **(b)**
CsCl is most ionic because of most electropositive nature of Cs.

77 **(c)**
Anion (O^-) repels the test electron because of same charge.

78 **(b)**
It is a fact.

79 **(b)**
Ionic radii decreases significantly from left to right in a period among representative elements

80 **(d)**
B and Si shows the diagonal relationship.

81 **(d)**
$O_2^- : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p^2 \begin{bmatrix} \pi 2p_y^2 \\ \pi 2p_z^2 \end{bmatrix} \begin{matrix} \pi^* 2p_y^2 \\ \pi^* 2p_z^1 \end{matrix}$

$\therefore$ B. O. $= \dfrac{10-7}{2} = 1.5$

82 **(a)**
ZnO can react with acid and base both
$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$
$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

83 **(d)**
While moving along a group from top to bottom, acidic nature of oxides decreases and along a period left to right acidic nature increases.

	amphoteric	acidic		max. acidic
	Al	Si	P	S
Z	13	14	15	16
	Al_2O_3	SiO_2	P_2O_3	SO_2

amphoteric acidic max. acidic

Thus, $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

85 **(b)**
Bond angles of ClF_3, PF_3, NF_3 and BF_3 are (180°, 90°), (101°), (106°) and (120°) respectively.

86 **(b)**

IE (II) of Na is higher than that of Mg because in case of Na, the second e^- has to be removed from the noble gas core while in case of Mg removal of second e^- gives a noble gas core
Mg has high first ionisation potential than Na because of its stable ns^2 configuration

87 **(d)**
Follow concept of bond order in M.O. theory.

88 **(c)**
sp^3-hybridization leads to tetrahedral geometry.

89 **(a)**
5 of P + 24 of O + 3 of − ve charge = 32.

91 **(c)**
SnO_2, Al_2O_3 and ZnO are amphoteric oxide.

92 **(c)**
The inert gas just after chlorine is argon.

93 **(b)**
Cation has small size than parent atom and anion has larger size than parent atom

94 **(c)**
Due to the presence of d-subshell electrons.

95 **(b)**
Coulombic forces are strongest among all .

96 **(b)**
Transition elements are those elements which have partially filled d-subshells in their elementary form. Therefore, the general electronic configuration of d-block element is $(n-1)d^{1-10}ns^{1-2}$.

97 **(a)**
In ionic solids, ions exist at lattice points. In covalent solids atoms lie at lattice points.

98 **(a)**
Ionic bond are non-directional.

99 **(c)**
Both carbon atoms have 2 σ- and 2 π-bonds

100 **(c)**
Diamond is hard, graphite is soft.

101 **(d)**
SiO_2 structure is definite.

102 **(d)**
P in PO_4^{3-} has sp^3-hybridization like S in SO_4^{2-}.

103 **(c)**
C − F bond is more polar than C − Cl.

104 **(b)**
Ionic radii $\propto \frac{1}{z_{eff}} \propto$ charge of anion
$\propto \frac{1}{\text{charge on cation}}$
Thus, the order of ionic radii is
$N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+}$

105 **(c)**
Ionic radii is the distance between the nucleus of an ion and a point upto which the nucleus has its influence on its electron cloud.
The size of ions increases on moving from top to bottom in a group. Hence, the maximum distance between the centres of cations and anions is in CsI because Cs is the largest cation and I is the largest anion.

106 **(b)**
Bond angles of BeF_2, H_2O, NH_3 and CH_4 are $180°, 104°31', 106°50', 109°28'$ respectively.

107 **(b)**
Count σ and π bonds.

108 **(b)**
The atomic radii decreases along the period and increases down the gp.

109 **(b)**
Ionisation energy increases along the period.

110 **(d)**
Due to dipole moment intramolecular forces of attraction becomes stronger and thus, liquefaction becomes easier.

111 **(d)**
$He_2^+(\text{B.O.} = 0.5) < O_2^-(\text{B.O.} = 1.5)$
$< NO(\text{B.O.} = 2.5) < C_2^{2-}(\text{B.O.} = 3.0)$

112 **(c)**
Larger is anion, more is covalent character.

113 **(c)**
Due to resonance structure of C_6H_6.

114 **(a)**
5 (on P) + 4(on H) − 1 = 8.

115 **(a)**
Pauling scale is based upon the excess bond energies. Pauling equation for determining the electronegativity of an element is
$X_A - X_B = 0.208\sqrt{\Delta}$
where, X_A, X_B =electronegativity values of elemnt A and B
Δ=polarity of $A - B$ bond.

116 **(a)**
Be^{2+} is smallest and Na^+ has largest radius.

117 **(b)**
Both have sp^2-hybridization geometry.

118 **(d)**
Non-polar species exert van der Waals' forces among themselves.

119 **(d)**
ICl_2^- has sp^3d-hybridization and has two bond pairs and three lone pairs of electrons.

120 **(d)**
Halogens are strong oxidising agents. The oxidising power halogen decreases from fluorine to iodine, because their reduction potential decreases from fluorine to iodine. The increasing order of their oxidising power is as

Element	I_2	$<$	Br_2	$<$	Cl_2	$<$	F_2
Reduction potential	$+0.54$		$+1.06$		$+1.36$		$+2.87$

121 **(c)**
CaO is basic oxide.

122 **(b)**
Be in BeF_3^- is sp^2-hybridized .

123 **(a)**
$_3Li - 1s^2 2s^1$ donates one electron easily

124 **(b)**
Ionization energy increases along the period and decreases down the group. Also (b) has [Ne] $3s^2, 3p^3$, *i.e.*, half filled configuration, being more stable and thus, have high ionization energy

125 **(c)**
Carbon cannot accept $6Cl^-$, since it has no vacant d-orbitals.

126 **(d)**
BCl_3 has sp^2-hybridization. Rest all have sp^3-hybridization having one lone pair of electron and thus, pyramidal in nature.

127 **(c)**
Both NH_3 and H_2O have sp^3-hybridization. CO_2 and $BeCl_2$ are linear (sp-hybridization)

128 **(d)**
The bond angles in sp^3, sp^2 and sp-hybridization are 109°, 120° and 180° respectively.

129 **(a)**
B. p. of H_2 is minimum.

130 **(b)**
e. g., BF_3.

131 **(a)**
s-orbitals never go for lateral overlapping because of non-directional nature.

132 **(c)**
H_2O possesses the tendency for H $-$bonding.

133 **(d)**
It is a reason for given fact.

134 **(c)**
It is a fact.

135 **(b)**
Rest all either has incomplete (BF_3, BeF_2) octer or expanded octet (ClO_2).

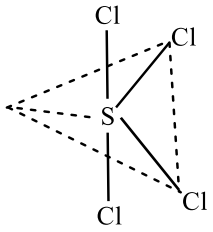
136 **(a)**
Bond energy increases with increase in bond order.

137 **(b)**
Electron affinity is defined as, "The energy released when an extra electron is added to a neutral gaseous atom."
Electron affinity of F=332.6 kJ/mol
Electron affinity of Cl=348.5 kJ/mol
Electron affinity of S=200.7 kJ/mol
Electron affinity of O=140.9 kJ/mol
Highest electron affinity among fluorine, chlorine, sulphur and oxygen, is of chlorine.
The low value of electron affinity of fluorine than chlorine is probably due to small size of fluorine atom *i.e.*, electron density is high which hinders the addition of an extra electron.

138 **(b)**
Bond order for $O_2 = 2$ and for $O_2^+ = 2.5$
Both are paramagnetic (O_2 has 2 unpaired electron, O_2^+ has one unpaired electron).

139 **(d)**
Bond order for $H_2^- = +1/2$.

140 **(c)**
S in SCl_4 is sp^3d-hybridized and possesses see-saw structure whereas $SiCl_4$ is tetrahedral.



141 **(d)**
$_{22}Ti : 3s^2, 4s^2 \xrightarrow{IE_1} 3d^2, 4s^1$
$_{23}V : 3d^3, 4s^2 \xrightarrow{IE_1} 3d^3, 4s^1$
$_{24}Cr : 3d^5, 4s^1 \xrightarrow{IE_1} 3d^5 \xrightarrow[\text{half filled}]{IE_2 \text{ from}}$ maximum
$_{25}Mn : 3d^5, 4s^2 \xrightarrow{IE_1} 3d^5, 4s^1$

142 **(c)**
In transition elements, penultimate shell electrons also participate in bonding.

143 **(a)**
With the discovery of inert gases (group zero in Mendeleef's Periodic Table), the law of octaves lost its original significance since, it was now the ninth element which had properties similar to the first one.

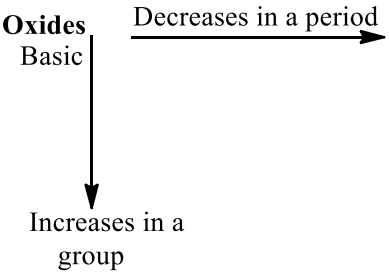
144 **(b)**
Na belongs to IA group and Mg belongs to IIA group. On moving from left to right in a period,

first ionisation energy increases, thus, IE of Mg is greater than the IE of Na.

IE order

$$Mg > Na$$

145 **(a)**



basic nature of oxides $Al_2O_3 < MgO < Na_2O < K_2O$

147 **(c)**

Total energy required for the conversion of one Mg atom into $Mg^{2+}$is $= IE_1 + IE_2$

$= 7.646 + 15.035$ eV

$= 22.681$ eV

$= 2188.6$ kJ mol^{-1}

Moles of Mg $= \frac{12\times10^{-3}}{24}$

$= 0.5 \times 10^{-3}$

∴ The energy required to convert 0.5×10^{-3} mol Mg into

$Mg^{2+} = 0.5 \times 10^{-3} \times 2188.6$

$= 1.09 \approx 1.1$

148 **(a)**

The size of isoelectronics decreases with increase in atomic number.

149 **(c)**

Since, the IVth IE is very high, *ie*, electron is to be removed from stable configuration, thus it has 3 valence electrons

150 **(b)**

These are facts.

151 **(a)**

The ionisation energy increases when we move from left to right in a period. But this increase is not regular. The members of second group have greater ionisation potential as compared to third group due to stable configuration.

Ionisation potential has following order

$Na < Mg > Al < Si$

152 **(c)**

Both SO_4^{2-} and BF_4^- have sp^3-hybridization and are tetrahedral.

153 **(d)**

First IP of Be > B because of stable ns^2 configuration

154 **(c)**

The correct order according to size is as

$O^{2-} > O^- > O$

155 **(a)**

Electron affinity generally increases in a period from left to right because size decreases and nuclear charge increases. But the electron affinity of nitrogen is very low due to extra stability of half-filled $2p$-orbital. Hence, the order of electron affinity is

$B < C < O > N$

156 **(c)**

Lithium is basic in nature and hence, it is not amphoteric.

157 **(c)**

Ions are held in NaCl by coulombic forces and thus, possess no velocity.

158 **(c)**

The jump in ionisation energy occurs when valence shell changes during removal of electron.

159 **(d)**

The correct order of ionic radii of these ions is

$$S^{2-} > Cl^- > K^+ > Ca^{2+}.$$

160 **(a)**

Nitrogen has more ionisation potential than carbon and oxygen because its outermost orbit is half-filled. So the order is C < N > O

161 **(b)**

Only p-orbitals give rise to σ-bond (head on overlapping) and π-bond (lateral overlapping).

162 **(b)**

Each has 22 electrons.

163 **(b)**

$BF_3 : sp^2$ $NO_2^-: sp^2$ $NH_3: sp^3$ $NH_2^-: sp^3$ $H_2O: sp^3$

164 **(a)**

Atomic and ionic radii increase from top to bottom in a group due to the inclusion of another shell at every step. Hence, Cs^+ ion will be the largest among given IA group ions (Na^+, $Li^+$and K^+)

165 **(a)**

Due to non-availability of d-orbitals, boron cannot expand its octet. Therefore, the maximum covalence of boron cannot exceed 4.

166 **(b)**

Larger anion is easily deformed (Follow Fajans' rule).

167 **(b)**

ClO_3^- has sp^3-hybridization with one lone pair of electron.

170 **(c)**

Silicon has the tendency to show covalent bonding because of higher IP values.

171 **(b)**

$BeCl_2$-sp; BF_3-sp^2; NH_3-sp^3; XeF_2-sp^3d

172 **(d)**

He has $1s^2$ configuration.

173 **(c)**

CO_2 is linear molecule.

174 **(b)**

Ionisation energies increase in a period on moving left to right while it decreases in a group on moving downward. The IE of Be is greater than B due to completely filled s-orbital. Hence, the order of IE is as

$$\text{Be} > B > Li > Na.$$

175 **(d)**

In inner transition elements, the differentiating electrons enter into $(6n-2)f$ orbital. Therefore, these elements are also known as f-block elements.

176 **(c)**

Ionic compounds conduct current in molten state.

177 **(a)**

Difference of electronegativity > 1.7 produces ionic compound.

178 **(c)**

Ionic radii $\propto \frac{1}{Z_{\text{eff}}}$

179 **(d)**

In sulphur, the excitation of np-electrons to nd-subshell gives rise to increase in number of unpaired electrons.

180 **(b)**

As the number of shells increases, ionic radii increases

182 **(d)**

Ionisation potential increases along the period.

183 **(a)**

$Sc^{3+} > Cr^{3+} > Fe^{3+} > Mn^{3+}$, the correct order is $Cr^{3+} > Mn^{3+} > Fe^{3+} > Sc^{3+}$

184 **(a)**

1. $1s^2, 2s^2, 2p^5 = 2, 7$

($\because$ It has capacity to accept electron therefore, it is electronegative.)

(b) $1s^2, 2s^2, 2p^4, 3s^1 = 2, 6, 1$
(configuration not correct ($2p^4$))

(c) $1s^2, 2s^2, 2p^6, 3s^1, 3p^5 = 2, 8, 6$

(configuration not correct $3s^1$)

(d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^5 = 2, 8, 7$

($\because$ It has capacity to accept electron therefore, it is electronegative)

Smaller the size, greater will be electronegativity. Since, element in choice (a) is smaller in size, it will be more electronegative than (d). In choice (a) the atomic number of element is 9, which is of fluorine and it is the most electronegative element of the Periodic Table.

185 **(d)**

IIIA group contains both metals and non-metals

186 **(b)**

Only P has d-orbitals.

187 **(c)**

The general electronic configuration of d-block element is $(n-1)d^{1-10}, ns^{1-2}$. They show variable oxidation state because d-electrons also take part in bond formation. They have degenerated orbitals. s and p-block elements in general do not show variable oxidation states.

189 **(a)**

BeF_3^- involves sp^2-hybridization.

190 **(d)**

The electron affinities of some of the elements of second period (*ie*, N, O, F, etc) are however, lower than the corresponding element (*ie*, P, S, Cl, etc) of the third period. This is due to the reason that the elements of second period have the smallest atomic size amongst the elements in their respective groups. As a result, there are considerable electron-electron repulsion within the atom itself and hence, the additional electron is not accepted with the same ease as is the case with the remaining elements in the same group

191 **(d)**

E°_{op} order is Mg > Fe > Cu; more is E°_{op}, more is electropositive character.

194 **(a)**

Non-metals are characteristically electronegative.

195 **(a)**

The relative extent to which the various orbitals penetrate the electron clouds of other orbitals is $s > p > d > f$. Electron will experience the greatest effective nuclear charge when in s-orbital, then a p-orbital and so on. Ionisation energy increases with an increase in penetration power and thus, the order of screening effect is $s > p > d > f$.

196 **(a)**

Carbon in H_2CO_3 has sp^2-hybridization and also

polar. BF_3 has sp^2 but non-polar. SiF_4 has sp^3-hybridization. $HClO_2$ has sp^3-hybridization.

197 **(c)**

$O^-(g) + e^- \rightarrow O^{2-}(g), \Delta H° = 844\ kJmol^{-1}$

This process is unfavorable in the gas phase because the resulting increase in electron-electron repulsion overweighs the stability gained by achieving the noble gas configuration.

199 **(c)**

The fifth period from nubidium (37) to xenon (54). The last electron enters in 5s, 4d or 5p-orbitals. Therefore, the fifth period has (2+10+6)18 elements.

200 **(d)**

Cs is more electropositive .

201 **(b)**

The element with atomic no. 105 is Dubnium. In IUPAC nomenclature, it is known as Un-nil-pentin.

202 **(b)**

Oxidizing power : $F_2 > Cl_2 > Br_2 > I_2$.

203 **(c)**

Halogens are most electronegative. Their general configuration is ns^2np^5

204 **(b)**

They have high electron density.

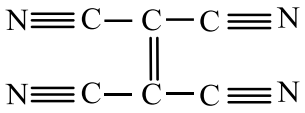
205 **(a)**

Cations are always smaller than their parent atoms:

$Al^{3+} < Al^{2+} < Al^+ < Al$.

206 **(c)**

$C_2(CN)_4$ is



C = C is sp^2-hybridization and C ≡ N is sp-hybridized.

207 **(a)**

Each species has 14 electrons and bond order for each is three.

208 **(b)**

Fluorine although have highest electronegativity due to its very small size, effective inter electronic repulsions are observed which brings down its electron affinity

209 **(c)**

$r_H = \frac{74}{2} = 37\ pm, r_{Cl} = \frac{198}{2} = 99\ pm$.

B. L. of $HCl = r_H + r_{Cl}$

210 **(a)**

Thus, excitation of 2s-elctron in N is not possible.

211 **(c)**

Second electron affinity of oxygen is endothermic and greater than first electron affinity, which is exothermic

212 **(a)**

Based on geometry of molecule.

213 **(a)**

$K^+ \rightarrow K^{2+} + e^-$. Since, e^- is to be removed from stable configuration

214 **(a)**

Proteins show H-bonding.

215 **(c)**

A reason for the given fact.

217 **(b)**

The intermolecular forces increase with increase in mol. Wt.

218 **(c)**

Atomic radius decreases on going from left to right in a period. Thus, size of $O > F$. As O^{2-} and F^- are isoelectronic, therefore size of $O^{2-} > F^-$

219 **(a)**

$Na^+ < F^- < O^{2-} < N^{3-}$

All are isoelectronic. Effective nuclear charge is highest for Na^+, so it has the smallest size

221 **(a)**

$_6C \rightarrow 1s^2, 2s^2, 2p^2$

$_5B \rightarrow 1s^2, 2s^2, 2p^1$

In first case IE_1 of $C > IE_1$ of B. Since, carbon is smaller than B in size. But $IE_2(B) > IE_2(C)$ because electron are paired as well as present in inner s-orbital whereas for carbon it will be still in 2p-orbital and in unpaired state

222 **(c)**

$KHF_2 \rightarrow K^+ + HF_2^-$

223 **(b)**

H_2O has sp^3-hybridizatio.

224 **(b)**

Bond energy of Cl_2 is higher among all halogen molecules. B. E. of F_2, Cl_2, Br_2, I_2 are 37, 58, 46 and 36 kcal mol^{-1} respectively.

225 **(b)**

Cl_2 involves 3p-3p overlapping.

226 **(c)**

CCl_4 has sp^3-hybridization giving regular tetrahedron geometry. In others the geometry is little distorted inspite of sp^3-hybridization due to different atoms on the vertices of tetrahedron.

227 **(c)**

Cl^- has $1s^2, 2s^2 2p^6, 3s^2 3p^6$ configuration.

228 **(c)**

N atom in NH_3 provides electron pair to H^+ to form coordinate or dative bond ($H_3N \rightarrow H$).

229 **(d)**
$IP_3 > IP_2 > IP_1$.

230 **(c)**
The order of stability matel oxides is as :
$Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$

231 **(a)**
First ionisation energy increases from left to right across a period, but Mg has extra stability than Al, due to full-filled $3s$-orbitals.
$Na_{11} = 1s^2, 2s^2, 2p^6, 3s^1$
$Mg_{12} = 1s^2, 2s^2, 2p^6, 3s^2$
$Al_{13} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^1$
$Si_{14} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^2$
The correct order of first ionisation potential is
$$Na < Mg > Al < Si$$

232 **(c)**
$1s^2, 2s^2 2p^4$ leads a sharing of two electron pairs to form molecule, $e.g.$, O_2.

233 **(b)**
M.O. configuration of N_2 is:
$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2, \pi 2p_y^2, \pi 2p_z^2, \sigma 2p_x^2$
M.O. configuration of N_2^+ is:
$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2, \pi 2p_y^2, \pi 2p_z^2 \sigma 2p_x^1$

234 **(a)**
Both are linear.

235 **(b)**
SO_2 has sp^2-hybridization.

236 **(d)**
The basic character of metal oxides decreases from left to right in a period due to decrease in electropositive character which in turn decreases the polarity of bond as well as the internuclear distance between the oxygen and metal atom. Therefore, alkali metal oxides are most basic and halogen oxide (oxygen halides) are most acidic ∴ K_2O is most basic metal oxide.

237 **(c)**
Same spin electrons in two atoms do not take part in bonding.

239 **(a)**
Count σ- and π-bonds.

240 **(d)**
Valency is according to valence shell configuration which here is $1s^2, 2s^2, 2p^3, ie, 5$

241 **(d)**
CaI_2 has maximum covalent character due to large size of anion and possesses lowest lattice energy. Thus melting point is lowest.

242 **(a)**
Nitrates of alkali metals on heating evolve oxygen gas (*e.g.*, KNO_3) while nitrates of p and d-block elements [*e.g.*, $(NO_3)_2$, $Cu(NO_3)_2$ and $AgNO_3$] gives out nitrogen dioxide on heating
$2KNO_3 \rightarrow 2KNO_2 + O_2$
∴ Nitrogen dioxide cannot be prepared from KNO_2.

243 **(a)**

Ions	Be^{2+}	Cl^-	S^{2-}	Na^+	Mg^{2+}	Br^-
Valence shell	1	3	3	2	2	4

Now, between Na^+ and Mg^{2+}, $Na^+ > Mg^{2+}$ (isoelectronic), between Cl^- and S^{2-}, $S^{2-} > Cl^-$ (isoelectronic) because for isoelectronic species size decreases as the atomic number increases.
Hence, the order of increasing size is
$Be^{2+} > Mg^{2+} > Na^+ > Cl^- > S^{2-} > Br^-$

244 **(d)**
$PCl_3 < PBr_3 < PI_3$, the bond angle order is explained in terms of increasing electronegativity of halogens, whereas, $PF_3 > PCl_3$, bond angle order is explained in terms of $p\pi - d\pi$ bonding in PF_3.

245 **(d)**
Hg exists in liquid state.

246 **(d)**
$117 = [Rn]5f^{14}, 6d^{10}, 7s^2 7p^5$
Since, the last electron enters in p-orbital, it will be a p-block element and its group number $= 5+2 = 7$ (VIIA)
So, the element would be the placed in halogen family.

247 **(b)**
The elements with atomic number 9, 17, 35, 53 and 85 are respectively F, Cl, Br, I and At. These are VII A group elements which are also known as halogens (which means originating from sea.) These also have 7 electrons in valence shell (*i.e.*, $ns^2 np^5$)
e.g.,
$$_9F = 1s^2, 2s^2, 2p^5$$
$$_{17}Cl = 1s^2, 2s^2 2p^6, 3s^2 3p^5$$

249 **(b)**
IE_1 of N > IE_1 of O due to half filled nature in N.

250 **(a)**
Solid molecules possess stronger van der Waals' forces.

251 **(c)**
SiF_4 has regular tetrahedral geometry.

252 **(b)**
IA—Alkali metals
IIA—Alkaline earth metals

IB—Coinage metals

253 **(c)**
The bond angle in CH_3OCH_3 is 110° inspite of sp^3-hybridization of O and two lone pair due to stearic hindrance.

254 **(a)**
Removal of electron is easier in f-block elements due to more shielding.

255 **(b)**
Seven atoms of fluorine are covalently bonded with iodine.

256 **(b)**
As a result of more overlapping. Note that π-bonds are formed after σ-has already formed.

257 **(d)**
$1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2$. Principal quantum number is 4, so it belongs to 4th period

258 **(d)**
Resultant of two opposite vectors produces zero dipole moment.

259 **(d)**
The trigonal geometry of BF_3 with three vectors (B → F) acting at 120° leads to zero dipole moment. In NH_3 three vectors (N ← H) act at 107° along with one lone pair giving dipole moment in molecule.

260 **(c)**
PF_5 involves sp^3d-hybridization.

261 **(c)**
$C < N > O$ is the correct order because N has stable configuration (exactly half-filled p-orbital $1s^2, 2s^2, 2p^3$).

262 **(c)**
(a) Metallic radii increase in a group from top to bottom.
Thus, Li $< Na < K < Rb$ is true
(b) Electron gain of enthalpy of Cl $> F$ and decreases along a group.
Thus, I $< Br < F < Cl$ is true.
(c) Ionisation enthalpy increases along a period left to right but due to presence of half-filled orbital in N, ionisation enthalpy of N $> O$.
Thus B $< C < N < O$ is incorrect.

263 **(c)**
Pauling work on chemical bonding.

264 **(d)**
The order of electron affinity among the halogens is
Cl $> F > Br > I$

265 **(c)**
Electronegativity of elements increases along the period and, decreases down the group.

266 **(d)**
Size of atom decreases with increase in atomic number across the period in Periodic Table.

267 **(a)**
Difference between S and $S^{2-}$is larger radii and larger size os S^{2-}.
As the radii of the anion is always larger than the atomic radii of its parent atom. In an anion as electron or electrons are added to the neutral atom, the nuclear charge acts on more electrons, so that each electron is held less tightly and thereby, the electron cloud expands.

268 **(d)**
NH_2^- has sp^3-hybridization having two covalent bonds and two lone pair of N atom.

269 **(a)**
Smaller is size of anion, lesser is its polarization, more is ionic nature, more is lattice energy.

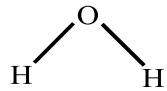
270 **(d)**
$HC \equiv C - HC = CH - CH_3$ $10\sigma, 3\pi$

271 **(d)**
The charge-size ratio increases and thus polarising power increases.

272 **(a)**
In a given group, atomic size increase due to addition of extra shell which outweighs the effect of increased nuclear charge. Number of shells increases with addition of extra electrons. Hence, increase in atomic size down the group is due to increase in number of electrons.

274 **(a)**
B is non-metal among Be, Mg, Al and B. Be Mg and Al are metals. Metallic character increases when we move down the group and decreases along period.

275 **(d)**
ICl_2^- has sp^3d-hybridized state
($i.e.$, trigonal bipyramidal shape but distorted due to the presence of lone pair of electron on I atom.)

276 **(b)**


H_2O has bonding.

277 **(d)**
Oxidizing power decreases in a group

278 **(a)**
Solubility order : AgF > AgCl > AgBr > AgI .

280 **(d)**

Phosphorus is a non-metallic element. It forms acidic oxide.

281 **(d)**

EA_1 for elements is exothermic and EA_2 is endothermic. Also EA_2 for $O > EA_1$ for O.

282 **(a)**

C_6H_6 has regular hexagonal geometry.

283 **(c)**

H-bonding is noticed in molecules having H atom attached on N, O or F.

284 **(d)**

One carbon has three bonds and other five where as each should have four bonds.

285 **(c)**

h-bonding in H_2O increases forces of attracting among molecules and develops abnormal properties.

286 **(a)**

2, 8, 2 because it would donate electron more easily

287 **(c)**

Bond energy increases with multiplicity of bonds.

288 **(d)**

Examine the positions in Periodic Table.

B C N O F

P S

Phosphorus is having stable half-filled configuration.

Hence, order is $B < S < P < F$

289 **(c)**

Both BrO_3^- and XeO_3 have sp^3-hybridisation and one lone pair of electron.

290 **(a)**

The electronic configuration of transition elements is exhibited by

$(n-1)d^{1-10}, ns^2$

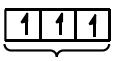
291 **(b)**

The bond order for $O_2^{2-}, O_2^-, O_2, O_2^+$ are 1.0, 1.5, 2.0, 2.5 respectively. higher is bond order, more is bond energy.

292 **(c)**

The electronic configuration of nitrogen is

$_7N = 1s^2, 2s^2, 2p^3$

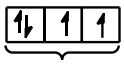
$2p^3$ 

half-filled p-orbital

Due to presence of half-filled p-orbital, (more stable) a large amount of energy is required to remove an electron from nitrogen. Hence, first ionisation energy of nitrogen is greater than that of oxygen.

The electronic configuration of oxygen is

$_8O = 1s^2, 2s^2 2p^4$

$2p^4$ 

Greater repulsion

The other reason for the greater IP of nitrogen is that in oxygen, there is a greater interelectronic repulsion between the electrons present in the same p-orbital which counter-balance the increase in effective nuclear charge from nitrogen to oxygen.

293 **(d)**

Multiplicity in bonds decreases bond lengths.

294 **(b)**

It is an ionic compound. The most ionic compound is CsF.

295 **(b)**

NO_2^- sp^2

NO_3^- sp^2

NO_2^- sp^3

NO_4^+ sp^3

SCN^- sp

296 **(a)**

It is the definition of valency.

297 **(c)**

$\equiv C -$ has 2σ- and 2π-(thus, sp-hybridization);

$-CH =$ has 3σ- and 1π-(thus, sp^2-hybridization).

Remember hybridized orbitals do not form π-bonds

298 **(d)**

IP of inert gases is maximum .

299 **(c)**

Bond angles decrease down the group.

300 **(a)**

Fluorine being most electronegative atom, has a high tendency to gain electron. Thus, it readily forms anions

301 **(d)**

A characteristic of metallic bonding.

303 **(a)**

Electron deficient species can accept lone pair of electron and thus, act as Lewis acid.

304 **(a)**

Brass in an alloy.

305 **(d)**

Ionic compounds having lattice energy higher than hydration energy are insoluble in water.

306 **(a)**

Electronegativity difference in two atoms involved in bonding is a measure of polarity in

molecule.

307 **(d)**

Electronegativity increases along the period and decreases down the group.

308 **(b)**

Ionization potential increases along the period. Also Be has $1s^2, 2s^2, i.e.$, removal of electrons from $2s$ while in Boron it occurs from $2p$ and therefore, Be has high I. P.

309 **(a)**

$Na \rightarrow Na^+ + e$; IE of $Na = +ve$

$Na^+ + e \rightarrow Na$; EA of $Na^+ = -ve$

Both are equal but opposite in nature.

310 **(c)**

Given,

Atomic number of element $B = Z$

($\because$ Noble gas $\therefore$ Belong to zero group)

Atomic number of element $A = Z - 1$

(*i.e.*, halogens)

Atomic number of element $C = Z + 1$

(*i.e.*, group IA)

Atomic number of element $D = Z + 2$

(*i.e.*, group II A)

$\because$ Element B is a noble gas.

$\therefore$ Element A must be a halogen *i.e.*, have highest electron affinity and element C must be an alkali metal and exist in$+1$ oxidation state.

And element D must be an alkaline earth metal with $+2$ oxidation state.

311 **(b)**

Both possess sp^2-hybridization but different geometry.

313 **(a)**

The addition of second electron in an atom or ion is always endothermic as the incoming electron experience the greater force of repulsion

314 **(a)**

$3 = 1s^2, 2s^1$

$12 = 1s^2, 2s^2, 2p^6, 3s^2$

Since, last electron enters in s-orbitals, these are s-bloc elements

315 **(d)**

Rest all are periodic properties of elements.

316 **(b)**

In the Periodic Table metals usually used as catalysts belong to d-block *e.g.*, Ni, Pt etc.

317 **(c)**

Bond order $C_2^- > NO > O_2^- > He_2^+$

$3 \quad 5/2 \quad 3/2 \quad 1/2$

318 **(a)**

It is a fact derived from bond order.

319 **(b)**

Due to sp^2-hybridization.

320 **(b)**

H-bond has its bond length in the range 2.5 Å to 2.75 Å.

321 **(b)**

It has sp^3d^3-hybridization with one lone pair on Xe.

322 **(c)**

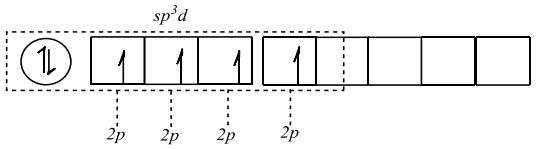
HCl exists as $H^{\delta+} - Cl^{\delta-}$ due to difference in electronegativity of H and Cl.

324 **(d)**

Each has 10 electrons

325 **(a)**

In SF_4, S has sp^3d-hybridization. Thus, it contains two axial and two equatorial bonds to give see-saw structure.



326 **(a)**

Van der Waals' forces increases in CH_4 to give solid CH_4.

327 **(b)**

Multiplicity in bonding give rise to an increase in bond energy.

328 **(b)**

The electron affinity (in kJ/mol)

Fluorine=332.6

Chlorine=348.5

Bromine=324.7

Iodine=295.5

Chlorine has highest electron affinity value, so, according to question the correct order of electron affinity will be $Cl_2 > F_2 > Br_2$.

329 **(c)**

According to M.O. theory, bond order of N_2, N_2^- and N_2^{2-} are 3, 2.5 and 2 respectively.

331 **(c)**

$$O_2^{2-}: \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2 \sigma 2p^2 \begin{bmatrix} \pi 2p_y^2 \\ \pi 2p_z^2 \end{bmatrix} \begin{matrix} \pi^* 2p_y^2 \\ \pi^* 2p^2 \end{matrix}$$

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

$$B_2 : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2 \begin{bmatrix} \pi 2p_y^1 \\ \pi 2p_z^1 \end{bmatrix}$$

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

332 **(c)**

C_2H_4 involves sp^3-hybridization on carbon atoms.

333 **(c)**

$[O-O]^{2-}$

334 **(d)**

The electronic configuration of carbon is $1s^2, 2s^2 2p^2$.

335 **(a)**

Only Na shows+1 oxidation state. Rest all have $+1, +2$ (Hg), $+1, +2$(Cu) and $+2, +3$(Fe) oxidation states.

336 **(a)**

Like gets dissolved in like. It is theory.

337 **(d)**

Cu loses two electron to form Cu^{2+}.

338 **(c)**

Only then it can accept lone pair in that shell.

339 **(a)**

The electron affinity of fluorine is lower than that of chlorine due to the very small size of fluorine in which negative charge is highly concentrated and repels the incoming electron thereby reducing the force of attraction of nucleus towards the adding electron and hence, decreasing the electron affinity.

Thus, chlorine has highest value of electron affinity.

340 **(b)**

In the Periodic Table, when one moves from left to right in a period, the acidity of oxides and halides of elements increases while it decreases when one moves from top to bottom in a group. Hence, PCl_3 is most acidic among given species.

341 **(d)**

It is the hybridization of ICl_2^+.

342 **(d)**

$_{20}Ca = [Ar]4s^2$

$_{21}Sc = [Ar]4s^2, 3d^1$

$_{22}Ti = [Ar]4s^2, 3d^2$

As d-orbital have diffused shape, hence their electron shields nuclear charge upto lesser extent. Hence, due to increase in effective nuclear charge (Z_{eff}) atomic size decrease, in the following order $Ca > Sc > Ti$

343 **(c)**

$\mu_{H_2O} \neq 0, \mu_{CO_2} = 0$

344 **(c)**

F_2 is most reactive due to

(1) highest electronegativity.

(2)low bond dissociation energy

(3)high heat of hydration of F^-ion

346 **(d)**

ClO_2 has 33 electron; one will be unpaired.

347 **(d)**

Down the group, size of atom increases. Therefore, bond length of LiF is less than that of NaF

348 **(c)**

$$\text{Bond order} = \frac{1}{2}[\text{bonding electrons} - \text{antibonding electrons}]$$

349 **(b)**

$sp^3\ d^2$-hybridization leads to octahedral geometry.

350 **(a)**

$$\text{Ionic radii} = \frac{n^2 a_0}{Z_{\text{eff}}}$$

351 **(c)**

H atom attached of F is responsible for H-bonding.

352 **(b)**

$Be_2(\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2)$ has bond order equal to zero.

353 **(c)**

The electronic configuration of element with atomic number 21 is

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$

Since, this element contains partly filled d-orbital, so it is a d-block element. d-block elements are also known as transition elements.

354 **(a)**

Head on overlapping give rise to σ-bond formation.

355 **(a)**

A species is amphoteric if it is soluble in acid (behaves as a base) as well as in base (behaves as an acid.)

$SnO_2 + 4HCl \rightarrow SnCl_4 + 2H_2O$

basic acid

$SnO_2 + 2NaOH \rightarrow Na_2SnO_3 + H_2O$

acid base

356 **(b)**

The first ionisation potential generally increases in a period from left to right and decreases in a group from up to down. Thus, the correct order of first ionisation potential is

$$K < Na < Be.$$

357 **(a)**

As we go down the group in Periodic Table, atomic size increases, force of attraction for the added electron decreases, hence electron gain enthalpy decreases.

$X(g) + e^- \rightarrow X^-(g)$

Actual order, $Cl > F > Br > I$

The fact that fluorine has a less electron gain enthalpy than chlorine seems to be due to the relatively greater effectiveness of $2p$-electron in the small F-atom to repel the additional electron entering the atom than do $3p$-electrons in the larger Cl-atom.

358 **(a)**

Bond angle for sp, sp^2 and sp^3-orbitals are $180°, 120°$ and $109°28'$ respectively.

359 **(d)**

Dipole forces exist only in polar molecule.

360 **(c)**

Reason being, as we move in period atomic radii decreases from left to right due to increase of effective nuclear charge.

$\therefore$ Na is larger in size than Mg and a neutral atom is larger than its positive ion.

362 **(a)**

Ionisation energy defined as the energy required to remove an electron from the outermost orbit of an isolated gaseous atom in its ground state.

$Na(11) = 1s^2, 2s^2, 2p^6, 3s^1$

$Na \rightarrow Na^+ + e^-$(First IE)

$Na^+ \rightarrow Na^{2+} + e^-$(Second IE)

First IE is lower and second IE is very higher, because removal of an electron from $Na^+$is very difficult.

363 **(b)**

Follow Fajans' rule to predict covalent nature.

364 **(c)**

BCl_3 has equilateral triangular shape leading to vector sum of polar bonds to zero.

365 **(c)**

The property of attracting electrons by an at atom of a molecule is called electronegativity. However, electron affinity is the amount of energy liberated when an electron is added to an isolated gaseous atom.

366 **(c)**

$Na(11) : 1s^2, 2s^2 2p^6, 3s^1$

It is an alkali metal. Alkali metal oxides are basic in nature.

367 **(c)**

Ionisation energy decreases down the group.

368 **(b)**

KO_2 is an ionic compound.

369 **(c)**

Oxygen cannot expand its octet due to absence of d-orbitals in its valence shell.

370 **(c)**

In case of isoelectronic species

Ionic radius $\propto \frac{1}{\text{nuclear charge}}$

Thus, the order of ionic radii of given ions is

$O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$

371 **(a)**

$1s^2, 2s^2 p^6, 3s^2 -$ In III transition e^- is to be removed from stable configuration

372 **(a)**

Atomic radius decreases along the period, increases down the group.

373 **(b)**

The size of isoelectronic decreases with increase in atomic number.

374 **(b)**

In K_2CrO_4, the oxidation state of Cr is $+6$.

Therefore, Cr has the minimum radius in K_2CrO_4

375 **(d)**

B in BF_3 has sp^2-hybridization.

376 **(b)**

Coinage metals are transition metals but they cannot work as transition metal because they have completely filled d-orbital.

Group 1B elements are called coinage metals (Cu, Ag, Au).

Their general outer electronic configuration is $(n-1)d^{10}ns^1$.

377 **(b)**

The ionisation energy of Tin (Sn) is less than that of lead (Pb). It is due to the poor sheilding of d- and f-electron in Pb, due to which it feels greater attraction from nucleus.

378 **(d)**

If the EN difference is 1.9, then bond is 50% ionic.

The difference in electronegativity is 2.8, therefore, percentage ionic character due to EN difference of 2.8 is

$\frac{2.8}{1.9} \times 50 = 73.6\%$

379 **(b)**

In a period from left to right the electropositive nature of elements decreases because nuclear charge increases. Hence, magnesium (Mg) is the most electropositive element among these.

380 **(a)**

F_3Cl has 10 electrons on Cl atom. A superoctet molecule means for expanded octet on an atom.

381 **(d)**

IE decreases in a group and increases in a period. Thus, Rb has the lowest IE

382 **(c)**
The outer electronic configuration $= s^2p^1$
Thus, valency $= 2 + 1 = 3$
Therefore, the formula of the oxide is X_2O_3
Since, it is an oxide of III group element, its nature is amphoteric

383 **(c)**
C_2, N_2 and F_2 has no unpaired electron in their molecular orbital configuration.

384 **(a)**
Noble gases have fully filled valence shell electronic configuration. Therefore, it represents ns^2np^6.

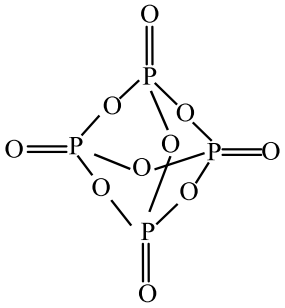
385 **(c)**
Ne, Ar, Kr, Xe and Rn are diamagnetic in nature.

386 **(d)**
Sulphur belongs to VI group of Periodic Table hence, it has maximum valency.

387 **(b)**
Dimerization occurs in carboxylic acids which indicates strong H-bonding.

388 **(c)**
Larger anion is polarized more (Fajans' rule).

389 **(a)**
P_4O_{10} is



390 **(b)**
Because of small atomic size and high nuclear charge, oxygen has the highest electronegativity among the given

392 **(c)**
The electronic configuration of the element having atomic number 106 is $[Rn]_{86}, 7s^1, 5f^{14}, 6d^5$
Since, the last electron enters in d-orbit, it is a d-block element. Its IUPAC name is unnilhexium (Unh)

393 **(b)**
Larger cation favours ionic bonding (Fajan's rule).

394 **(b)**
Bond dissociation energy order:
$Cl_2 > Br_2 > F_2 > I_2$
242.6 192.8 158.8 151.1 in kJ mol^{-1}

395 **(c)**
BCl_3 has six electrons in outer shell of boron atom.

396 **(c)**
Anions are larger in size than their parent atom.

397 **(b)**
Bond order for $O_2 = 2; O_2^+ = 2.5; O_2^- = 1.5, O_2^{2-} = 1$
Thus bond length is $O_2^+ < O_2 < O_2^- < O_2^{2-}$

398 **(a)**
Atomic size increases as we move from top to down in a group, therefore, the amount of energy required for ejection of an electron from atom decreases *i.e.*, ionisation energy decreases. Hence, the correct order of IE_1 is
$Li > Na > K > Cs$

399 **(d)**
Unpaired electrons give rise to paramagnetis.

400 **(a)**
Bond order $= \frac{1}{2}$ [no. of bonding electron – no. of antibonding electron]

402 **(b)**
SiO_2 possesses giant molecular structure due to tetra valence and catenation nature of Si

403 **(a)**
NO has 15 electrons.

404 **(b)**
The bond length are :
$\underset{107\text{ pm}}{C-H} < \underset{134\text{ pm}}{C=C} < \underset{141\text{ pm}}{C-O} < \underset{154\text{ pm}}{C-C}$

405 **(c)**
Inspite of three polar bond, the lone pair of electron on N atom decreases the dipole moment of NF_3 than NH_3.

406 **(b)**
Atomic radii decrease in a period from left to right, hence, fluorine has a very less atomic radii (covalent atomic radii =0.72Å). But inert gases (like Ne) are monoatomic gases, hence, their convalent atomic radii cannot be found out. In fact, their calculated atomic radii is the van der Waals' radii, which is found almost double to covalent radii, hence, the van der Waals' radius of neon (Ne) is about 1.60Å.

407 **(a)**
∵ During ionisation, energy is supplied to atom in order to take out electron from it. Energy of atom increases when an electron is removed from atom.

408 **(b)**
Only sulphur has d-orbitals.

409 **(c)**
It is a fact of VSPER theory.

410 **(b)**
Both have one lone pair of electron.

411 **(d)**
These are characteristics of resonance.

412 **(b)**
$K_4Fe(CN)_6 \rightarrow 4K^+ + Fe(CN)_6^{4-}$.

413 **(a)**
Like gets dissolved in like.

414 **(a)**
These atomic numbers give the configuration ns^2np^5 which is of halogen group or VIIth group

415 **(c)**
In O^{2-} effective nuclear charge is minimum due to more number of electrons and thus the size of O^{2-} is maximum.

416 **(b)**
More directionally concentrated orbitals show more overlapping.

417 **(a)**
$E_1 < E_2$, because second IE is greater than first IE

418 **(d)**
Halogens have highest electron affinity in the Periodic Table and it decreases down the group. Chlorine has highest electron affinity and fluorine has lower electron affinity than chlorine due to its small size and repulsion between electrons present in it and added electron. The order of electron affinity is
$F < Cl > Br > I$

419 **(b)**
Fluorine has low EA than chlorine because of smaller size of fluorine and compact $2p$-orbital where interelectronic repulsion is more

420 **(c)**
Carbon in CO_2 has sp-hybridization.

421 **(d)**
O has two lone pair of electrons.

422 **(a)**
2nd IE_1 of alkali metals is abnormally higher.

423 **(b)**
$K^+[C \equiv N]^-$; K^+ and CN^- ionic, C and N forms covalent bonds .

425 **(b)**
More is s-character, smaller is hybridized orbital, more becomes tendency for overlapping, more is bond energy, lesser is bond length.

426 **(b)**
Alkali metals are always univalent.

427 **(d)**
Generally, d-block elements are called transition elements as they contain inner partially filled d-subshell. Thus, their general electronic configuration is $(n-1)d^{1-10}, n^{1-2}$.

428 **(b)**
Electron affinity decreases down the group, but 'O' has small atomic size and $2p$-orbital becomes very compact and already has 6 electrons, hence, there is a repulsive force among the already present and added electrons. Some of the energy evolved, due to addition of electron, is used to reduce the repulsion. Hence, the E.A. of O is less than S, so the order is $S > O > Se$.

429 **(d)**
BeO is basic oxide and reacts only with an acid to form the salt while
ZnO, SnO_2 and $Al_2O_3$are amphoteric oxides which are react with acid and base both.

430 **(d)**
Both C and N^+ have six electrons.

431 **(c)**
The size of isoelectronic species decreases with increasing nuclear charge. Hence, the order of ionic radii of N^3, $O^2$and F is as

N^3	>	O^2	>	Fl
1.71		1.40		1.36

432 **(a)**
$\mu = \sqrt{\mu_1^2 + \mu_2^2 + \mu_1\mu_2 \cos\theta}$, if $\theta = 90°\mu$ is maximum.

433 **(d)**
More is electronegativity difference, more is ionic character.

434 **(c)**
On passing from left to right in a period, acidic character of the normal oxides of the element goes on increasing with increases in electronegativity

435 **(b)**
Due to larger difference in electronegativity.

436 **(b)**
Small cation has more polarizing power .

437 **(b)**
Ionisation potential generally increases in a period from left to right but $1E_1$ of $N_2$is greater than that of O_2. It is due to the more stable (half-filled orbitals) configurations of N.

438 **(d)**
Ionisation potential is the amount of energy required to take out most loosely bonded electron

from isolated gaseous atom. Its value increases in a period. Element having stable configuration have exceptionally high ionisation potential
N has highest ionisation potential among C, B, O and N ($\because$ N has $2p^3$stable configuration).

439 **(b)**
C^{4-}, $N^{3-}$and $O^{2-}$are isoelectronic species. The ionic radius of isoelectronic species decreases with increase the nuclear charge. Hence, the order of ionic radius is

Species	C^{4-}	>	N^{3-}	>	O^{2-}
Ionic radii(Å)	2.60		1.71		1.40

440 **(b)**
Energy level order $2p > 2s$.

441 **(a)**
Bond angles decreases on moving down the group for similar compounds, $i.e.$, $NH_3 > PH_3 > AsH_3 > SbH_3$.

442 **(d)**
The resultant dipole in regular tetrahedron is zero.

443 **(b)**
Intermolecular H-bonding gives rise to an increase in b. p.

444 **(c)**
M.O. configuration of O_2 is
$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p^2, \pi 2p_x^2, \pi 2p_y^2, \pi^* 2p_x^1, \pi^* 2p_y^1$

446 **(b)**
HCl and $AlCl_3$ are covalent but give ions in solution.

447 **(d)**
Characteristics of bond order concept.

448 **(b)**
Cations are always shorter than their parent atom, anion are always larger.

449 **(a)**
O_2^- has one unpaired electron.

450 **(b)**
The bond formation process is exothermic and thus resultant acquires lower energy level.

451 **(b)**
H_2O is sp^3-hybridized; BeF_2 is sp-hybridized.

452 **(d)**
As the nuclear charge per electron is maximum in P^{5+}. Therefore, its size is smallest

453 **(b)**
The physical and chemical properties of elements are periodic functions of their electronics configuration. This is the correct statement.

454 **(b)**

2. $Br_2$is the only non-metal which is liquid at room temperature.
3. Hg is metal which is liquid at room temperature.
4. $NH_3$is gas at room temperature.

455 **(a)**
CH_3^+ possesses sp^2-hybridization.

457 **(a)**
Larger anion is more polarized.

458 **(b)**
The ionic radius in general increase moving top to bottom and further decreases moving left to right. So, the correct order is :

Na^+ >	Li^+ >	Mg^{2+} >	Be^{2+}
0.95Å	0.68 Å	0.65 Å	

459 **(d)**
Electron affinity increases across the period

461 **(b)**
F has 7 electrons in its valence shell. Thus, to attain stability, it should have lost one electron.

464 **(a)**
Ionisation potential is the energy required by an atom to lose electron and their ionisation potential is high.

465 **(a)**
Mg^{2+} is a smaller cation in these. Smaller is cation more is hydration energy.

466 **(b)**
NH_3, $[PtCl_4]^{2-}$, PCl_5 and BCl_3 have sp^3, $dsp^2 sp^3 d$ and sp^2 hybridization respectively. Note that hybridization of P in PCl_5 is wrongly reported in problem.

467 **(d)**
In alkali metals reactivity increases down the group as electropositivity increases, but for halogens F_2 is more reactive as moving down molecular stability increases.

468 **(d)**
Ionisation energy generally increases from left to right in a period but ionisation energy of nitrogen is greater than oxygen due to stable p^3configuration. Hence, the order is as
$C < O < N < F$

469 **(c)**
Cations are smaller in size than their parent atoms.

470 **(a)**

The order of the ionic radii of the given species is

$F^- < O^{2-} < N^{3-}$

or 1.36 1.40 1.71

471 **(c)**

The ionisation potential decreases down the group (due to increases in size of atom) and increases in a period from left to right.

$\therefore$ Out of the given choices $Li > K > Cs$ is correct.

472 **(d)**

$O^{2-}, F^-, Na^+, Mg^{2+}$ and Al^{3+} are isoelectronic species and higher the nuclear charge, smaller the size of isoelectronic species.

473 **(a)**

Due to larger difference in electronegativity .

474 **(d)**

sp^3d-hybridisation leads to trigonal bipyramidal geometry if no lone pair is present, $e.g.$, PCl_5; in ClF_3 geometry is T shaped due to the presence of two lone pair of electron. In XeF_2, geometry is linear due to the presence of three lone pair of electrons.

475 **(d)**

Formation of solid lattice from oppositely charged ionized gaseous atoms give rise to evolution of lattice energy.

476 **(d)**

Due to H-bonding, $V_{ice} > V_{water}$.

477 **(b)**

Outer shell electrons are referred as valence electrons.

478 **(a)**

IF_5 is square pyramid (sp^3d^2-hybridisation in I); PCl_5 is trigonal bipyramid (sp^3d-hybridisation in P).

479 **(c)**

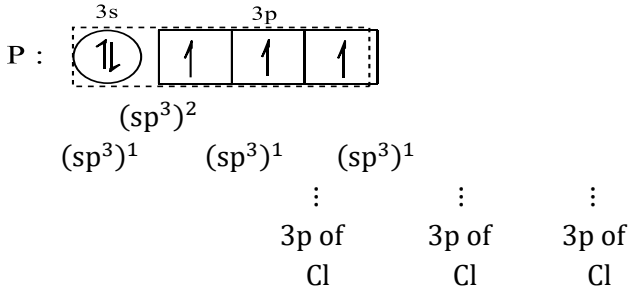
Operates in each gaseous molecule.

480 **(a)**

Dipole moment of $CH_4 = 0$.

481 **(b)**

PCl_3 has sp^3-hybrisation and possesses one lone pair on P-atom and three bond pairs of electrons



482 **(b)**

Bond order $= \frac{1}{2}$[no. of bonding electrons – no. of antibonding electrons].

483 **(a)**

π-bonding occurs only after σ-bond is formed.

484 **(c)**

NaF is more ionic; F is smaller anion among all and thus, least polarized.

485 **(b)**

The stability of carbonates increases with increasing electropositive character of metal.

487 **(c)**

Molecular orbital configuration of,

$C_2^+ = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2, \pi 2p_y^1$

488 **(a)**

Stevenson's scale is not a scale of measuring electronegativity.

489 **(d)**

An increase in s-character give rise to an increase in bond strength.

490 **(d)**

Ti^+ has 21 electrons in it. Rest all have 10 electrons.

491 **(c)**

Size of isoelectronics decreases with increasing atomic number.

492 **(a)**

M.O. configuration of O_2 :

$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2 \begin{bmatrix} \pi 2p_y^2 \\ \pi 2p_z^2 \end{bmatrix} \begin{bmatrix} \pi^* 2p_y^1 \\ \pi^* 2p_z^1 \end{bmatrix}$

Molecular orbitals $\pi^* 2p$ gains electron when O_2^- is formed from O_2.

493 **(a)**

During the formation of cation, the size decreases

494 **(d)**

Follow text.

495 **(b)**

Metallic character $\propto$ atomic size

$\propto \frac{1}{\text{nuclear charge}}$ (for a period only)

Metallic character decreases across a period from left to right because atomic size decreases.

In a group from top to bottom, metallic nature increases due to increase in atomic size.

496 **(a)**

Bond formation is always exothermic. Compounds of sodium are ionic.

498 **(a)**

The bond angle of AX_3 type molecules with one lone pair decreases down the gp due to decreasing electronegativity of central atom

which causes lower repulsion between lone pair-bond pair electrons.

500 **(d)**

These are characteristic of hydration.

501 **(a)**

Ionic radii $\propto \frac{1}{Z_{eff}}$

Z_{eff} =Effective nuclear charge

This Z_{eff} is calculated as follows

Z_{eff}=Z−screening constant (σ)

The value of screening constant is based upon the number of electrons in valence shell as well as in penultimate shells.

503 **(d)**

Electron affinity is defined as "the energy released when an extra electron is added to neutral gaseous atom. The increasing order of electron affinity is

$$2s^2 2p^4 < 3s^2 3p^4 < 2s^2 2p^5 < 3s^2 3p^5$$

$$O < S < F < Cl$$

General electron affinity decreases with the increase in the size of atom, since nuclear attraction decrease down a group. The value of electron affinity increase as we move along a period since the size of atoms decrease in a period. Electron affinity of O and F are less than S and Cl respectively due to very small size.

504 **(b)**

Anions are always larger than parent atom; cations are always lesser than parent atom.

505 **(b)**

The size of an anion is larger than its corresponding neutral atom and the size of cation is smaller than its corresponding neutral atom. Hence, the order of the size of iodine species is as $I^- > I > I^+$.

506 **(a)**

The stability of hydrides decreases down the gp, *i.e.*, from NH_3 to BiH_3 which can be observed from their bond dissociation enthalpy. The correct order is

$NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

Property	NH_3	PH_3	AsH_3	SbH_3	BiH_3
$\Delta_{diss}H^-(E-H)$ /kJ mol^{-1}	389	322	297	255	−

507 **(b)**

$R - O - H \cdots H - O - H$

508 **(c)**

M.O. configuration of N_2^-:

$$\sigma 1s^2\ \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2 \begin{bmatrix} \pi & 2p_y^2 \\ \pi & 2p_z^2 \end{bmatrix}, \sigma 2p_x^2\ \pi^* 2p_y^1$$

B. $O = \frac{1}{2}[10 - 5] = 2.5$

509 **(b)**

F is the most electronegative element which cannot loose electron to other so it exhibits only−1 state. Na is alkali metal which can loose only one electron so exhibits only +1 state.

510 **(c)**

IF_5 has sp^3d^2-hybridization with one lone pair on I atom.

511 **(c)**

In general ionisation energy increases as we move from left to right in a period. It is due to the increase in effective nuclear charge. IE_1 of Be and N is high due to stable configuration. Hence, the order is as follows F > N > C > Be > B

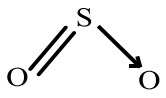
512 **(c)**

Notice configuration of N^+, C^+, O^+ and F^+.

513 **(a)**

F has the highest electronegativity because of its smallest size

514 **(b)**

SO_2 has sp^2-hybridization due to  geometry.

515 **(c)**

H −bonding order:

$\cdots H - F > \cdots H - O > \cdots H - N$

516 **(c)**

First electron affinity is energy releasing process.

517 **(d)**

The overlapping orbitals must possess half-filled nature with anti-spin electron.

518 **(b)**

Noble gases are in zero group however they possess eight electrons in their valence shell.

519 **(b)**

Electronegativity is the tendency to attract the shared pair of electron towards itself. It decreases down the group and increases in period.

Fluorine has highest electronegativity among all existing elements.

Elements	Cl	>	Br	>	P	>	Si
Electronegativity	3.0		2.8		2.1		1.8

∴ Electronegativity of Cl is highest among given elements.

520 **(b)**

E_1 for $He^+ = E_1$ for $H \times Z^2$ (where Z = at.no. of He).

521 **(b)**
Covalent compounds have lower m.p. and b.p. than ionic one.

522 **(a)**
Bonding molecular orbitals possess lower energy levels than antibonding orbitals.

523 **(b)**
Hybrid orbitals never form π-bond.

524 **(b)**
Element with atomic number 20 is metal (Ca); it will combine with non-metal.

525 **(b)**
Ionisation energy of Ist group elements decreases down the group because in groups from top to bottom atomic size increase. Due to increase in atomic size, the nuclear attraction of outer electron is reduced. They easily removed from valence orbital. So ionisation energy is reduced from top to bottom in a group.

526 **(b)**
Both BF_4^- and NH_4^+ have sp^3-hybridisation and therefore possess tetrahedral geometry.
$NF_3 : sp^3$ $BCl_3 : sp^2$
$BF_3 : sp^2$ $BrCl_3 : sp^3d$
$BF_4^- : sp^3$ $NH_3 : sp^3$
$NH_4^+ : sp^3$ $NO_3^- : sp^2$

527 **(c)**
Smaller the size of cation, more is ionic character, more is attraction among ions.

528 **(a)**
In PCl_3 and $POCl_3$, P atom is sp^3-hybridized.

529 **(b)**
NO_3^- has sp^2-hybridization and possesses coplanar or equilateral triangular geometry.

531 **(a)**
H_2O shows high b.p. (inspite of lowest mol.wt.) on account of strong H-bonding.

532 **(d)**
$+4$ ionic state is not possible for lead with iodide because I^- reduces Pb^{4+} to Pb^{2+}.

533 **(c)**
Electronegativity and ionisation energy decreases from F to I.

534 **(a)**
$BeCl_2$ has the highest melting point due to ionic bond

535 **(b)**
According to valence bond theory, overlapping orbitals must possess half-filled nature as well as antispin electron.

536 **(b)**
$Be(1s^2 2s^2)$ because of the presence of fully filled $2s$-subshell has least tendency to take up an electron. Hence, Be^- is least stable

538 **(c)**
Both $HgCl_2$ and C_2H_2 are linear like CO_2 because of sp-hybridization.

539 **(b)**
SF_4 has sp^3d-hybridization. Rest all have sp^3-hybridization.

540 **(d)**
The elements present in the earth's core are collectively called siderophiles. These are found in their native state. These elements generally have a low reactivity and exhibit an affinity to form metallic bonds. *e.g.*, Pt, Ru, Pd, Ir, Os etc.

542 **(d)**
The ionic radius increases down the group.

543 **(c)**
Since, the d-orbital of the element is incompletely filled, it is a d-block element

544 **(a)**
$H_3O^+ : sp^3$; $NO_3^- : sp^2$

545 **(d)**
H is attached on N atom.

546 **(b)**
IP_1 of B $>$ IP_1 of Li ENC of boron is more than Li.
Also IP_1 of Li $>$ IP_1 of K because removal of electron in K occurs from $4s$.

547 **(b)**
CsCl is ionic.

548 **(a)**
Two like atoms involved in bonding can form only two π-and one σ-bond within themselves because π-bonds are formed by p-orbitals and only when σ-has already formed. Remember only three p-orbitals exist.

549 **(c)**
Intramolecular H-bonding in salicyl aldehyde prevents its test with $FeCl_3(aq)$.

550 **(a)**
H-bonding is weakest bonding.

551 **(a)**
ClO_2 has 33 electrons, *i.e.*, one unpaired.

552 **(d)**
Sodium and chlorine are in same period
$_{11}Na = 2, 8, 1$
$_{17}Cl = 2, 8, 7$
Both have 3- shells, hence they both are placed in 3rd period of Periodic Table.

553 **(b)**
Basic character of hydrides decreases down the gp.

554 **(a)**
The definition of bond order.

555 **(d)**
In $BeCl_2$, Be atom has incomplete octet.

556 **(b)**
Due to H-bonding which is more in water than alcohol and not in ether.

558 **(d)**
If the lattice energy < hydration energy, then only ionic compounds are soluble.

559 **(c)**
H-bonding in molecule gives rise to increase in its b.p.

560 **(b)**
Since, e^- is to be removed from exactly half-filled p-orbital

561 **(d)**
At 25°C and 1 atm pressure bromine and mercury (Hg) are liquid. Chlorine (Cl) is gas and phosphorus (P) is solid. (m.p. of white phosphorus=44°C)

562 **(c)**
Allene is $CH_2 = C = CH_2$.

563 **(c)**
Basic character of hydrides is $NH_3 > PH_3$.

564 **(c)**
(a) Nuclear charge and electron affinity both increase in period and decrease in group.
(b) Ionisation energy and electron affinity both increase from left to right in a period and top to bottom in a group.
(c) Atomic radius decreases from left to right in a period and increases from top to bottom in a group whereas electron affinity increases from left to right in a period and decreases from top to bottom in a group.

565 **(a)**
Covalent radius are always smaller than crystal radius as the former involves overlapping region.

566 **(b)**
Multiplicity in bonds decreases bond length.

567 **(d)**
These are factors on which effective nuclear charge depends.

568 **(a)**
In a period, from left to right basic character of oxides decreases, thus Na_2O is most basic

569 **(c)**
All the ions belong to same period thus for them cations will be smaller than anions. Now, $O^{2-}$and $F^-$are isoelectronic and $r_n \propto \frac{1}{Z}$
Thus, ionic radius of $O^{2-}(Z = 8) > F^-(Z = 9)$.

570 **(a)**
Due to the presence of lone pair on N atom.

571 **(a)**
Pauling's electronegativity values for elements are useful in predicting polarity of bonds in molecules.

572 **(c)**
Larger is anion, more is its polarization.

573 **(d)**
Fluorine has maximum reduction electrode potential ($E°_{F/F^-}$) =2.87 V, hence, it is easily reduced into $F^-$and consequently $F_2$is the best oxidising agent.

575 **(d)**
The metallic character is found in iodine as well as in astatine (At). Note that metallic character increases down the group.

576 **(a)**
Ionization energy increases along the period and decreases down the group.

577 **(d)**
These are the factors on which IP depends.

578 **(d)**
Cl is more electronegative than Br.

579 **(b)**
Mg^{2+} is smaller than Na^+ and thus, smaller is cation more is hydration energy.

580 **(c)**
Electron affinity order for halogens is Cl > F > Br > I.

581 **(d)**
The characteristic to be observed during removal of II electron.

582 **(a)**
It is a concept.

583 **(d)**
Mullikan proposed M.O. theory.

584 **(d)**
Proton (H^+) can only accept a lone pair from donor atom.

585 **(d)**
Bond order for He_2 is zero.

586 **(a)**
According to Fajans' rule, polarization of anion is influenced by charge of cation, size of cation. More is the charge on cation, more is polarization of

anion.

587 **(b)**
$CH_2 = CH_2$ has 1σ-and 1π-in between two sp^2-hybridized carbon.

588 **(b)**
Follow Fajans' rule.

589 **(c)**
Stronger is metallic bonding (Fe has d-subshell), more is hardness.

590 **(b)**
It has 3σ-and 1π-bond.

591 **(b)**
Half filled orbitals are more stable.

592 **(c)**
Atomic size decreases along the period and increases down the gp.

593 **(d)**
Anions are always larger in size than their parent atom. Cations are always smaller in size than their parent atom.

594 **(a)**
More is the dipole moment more is ionic nature.
$\mu = \delta \times d$; higher is μ, more will be δ on the atom.

595 **(c)**
Electronic configuration reveals that the p-orbital of the element is not complete. Therefore, it is a p-block element. Moreover, the atomic number of the element is 33(As). Therefore, it is a metalloid.

596 **(c)**
SF_6 has six $S-F$ bonds.

598 **(c)**
All physical and chemical properties of elements are periodic function of atomic number-Modern Periodic Law.

599 **(a)**
s-orbitals always lead head on overlapping .

600 **(b)**
Smaller is atom, more is energy needed to remove electron, $i.e.$, ionisation energy. Also removal of two electrons needs more energy.

601 **(b)**
A reason for the given fact.

602 **(b)**
Cs is metal and solid.

603 **(a)**
Due to planar equilateral geometry of graphite.

604 **(c)**
$2Fe + 3[O] \rightarrow Fe_2O_3$(rust).

605 **(a)**
Electronegativity The tendency of an atom in a compound to attract a pair of bonded electrons towards itself is known as electronegativity of the atom.
Fluorine is most electronegative element because of smaller size and greater tendency to gain electron.

606 **(d)**
The trivalent ion having largest size is lanthanum. This is due to lanthanide contraction

607 **(d)**
P atom has sp^3-hybridization with one position occupied by lone pair of electron.

608 **(b)**
Lower IE, more EA and high lattice energy are required conditions for ionic bonding.

609 **(c)**
Al_2O_3 behaves as an amphoteric oxide.
$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
$Al_2O_3 + 2NaOH \xrightarrow{\Delta} 2NaAlO_2 + H_2O$

610 **(a)**
H atom has $1s^1$ configuration. Shielding effect is property of penultimate shell electrons.

611 **(b)**
$Mg \rightarrow Mg^+, E = 750$kJ
Remaining energy $= 1200 - 750 = 450$kJ
Energy needed to convert 1 mole of Mg^+ to $Mg^{2+} = 1450$
Number of moles Mg^{2+}produced
$$= \frac{1}{1450} \times 450$$
$$= 0.31$$
$$= 31\%$$
Number of moles of Mg^+produced $= 1 - 0.31$
$$= 0.69$$
$$= 69\%$$

612 **(b)**
$CCl_2 = CCl_2$ has sp^3-hybridization. CCl_4 has sp^3-hybridization.

613 **(a)**
Both NH_4^+ and BF_4^- have sp^3-hybridization.

614 **(d)**
O is more electronegative than C.

615 **(d)**
SF_4 has sp^3d-hybridization with one lone pair;
CF_4 has sp^3-hybridization with no lone pair and
XeF_4 has sp^3d^2-hybridization with two lone pairs.

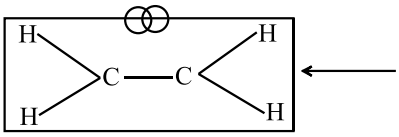
616 **(a)**
H-bonding is weakest bonding.

617 **(d)**
Cs^+ is biggest ion among these. F^- is smallest.

618 **(c)**
All are non-metals.

619 **(d)**
Dipole moment of CH_3OH is maximum in these .

621 **(a)**
A π-bond has a nodal plane passing through the two bonded nuclei, *i. e.*, molecular plane.



622 **(d)**
S^{2-} has the largest size and hence, has the lowest ionisation energy

625 **(d)**
These are the factors on which van der Waals' forces depend.

626 **(b)**
Removal of two electrons (one by one) from an atom requires energy $= IP_1 + IP_2$.

627 **(a)**

628 **(d)**
Smaller is anion, lesser is its polarization.

628 **(d)**
H atom attached on N, O, F develops hydrogen bonding molecule.

630 **(b)**
CH_3OH shows H $-$ bonding in liquid state.

631 **(b)**
IP_1 of Pb $>$ IP_1 of Sn(an exception).

632 **(d)**
In s-block elements, electron enter into the ns-orbitals.
For atomic number 3=$1s^2, 2s^1$
Atomic number 12=$1s^2, 2s^2 2p^6, 3s^2$

633 **(b)**
Ionisation energy increases in a period from left to right. But IE_1 of Be is greater than B due to its stable configuration ($1s^2, 2s^2$).
Hence, the order of decreasing
$IE_1$is C $> Be > B > Li$

634 **(d)**
CH $\equiv$ CH; 3 for triple bonds and two for C $-$ H bond.

635 **(c)**
$Z = 2, 8, 8, 1$. Because it would donate e^- more easily

636 **(c)**
Maximum covalence in most of the atoms (except N, O, F) is given by the number of valency electrons. The paired s electrons are also get unpaired during excitation.

637 **(a)**
In N_2, all electrons are paired. Thus, N_2^+ has one electron unpaired.

638 **(d)**
Bond length decreases with increase in s-character.

639 **(b)**
Anions are always larger than their parent atom.
Also atomic radius increases down the group, decreases along the period.

640 **(c)**
It is head on overlapping and thus, forms more stronger bond.

641 **(c)**
O atom possesses two lone pair of electrons .

642 **(a)**
Thermal stability of the hydrides decrease as we go down the group in Periodic Table for group 15 (N-family)

$$BiH_3 < SbH_3 < AsH_3 < PH_3 < NH_3$$

	Least stable			Most stable
M-H	255	247	322	391
Bond-energy				
$kJmol^{-1}$				

643 **(c)**
Benzene has 12σ- and 3π-bonds.

644 **(c)**
$SbCl_5^{2-}$ has sp^3d^2 and rest all has sp^3d-hybridisation.

645 **(b)**
Electron gain enthalpy of Cl is maximum.

647 **(b)**
One bonding molecular orbital and one antibonding .

648 **(b)**
Ionisation energy is the amount of energy required to take out most loosely bonded electron from an isolated gaseous atom. In a group when

we move from top to bottom, ionisation energy decreases due to increase in size. In a period while moving from left to right ionisation energy increase due to increase in size. In a period while moving from left to right ionisation energy increase due to increase in size.
$\therefore$ Be $> Mg > Ca$ ($\because$It is the order of increasing ionisation energy when we move from top to bottom in group II A).

649 **(c)**
Generally electron affinity increases in a period and decreases in a group but due to smaller size and high electron density on fluorine atom, it experience high interelectronic repulsions. Thus, F^-ion is less stable in comparison to Cl^-ion. Hence, electron affinity is highest for chlorine. Its electronic configuration is
$_{17}Cl = 1s^2, 2s^2 2p^6, 3p^2, 3p^5$

650 **(c)**
Boron in $[BF_4]^-$ has regular tetrahedral geometry because of sp^3-hybridization on boron atom.

651 **(d)**
The size of an species decreases with increasing nuclear charge because the attraction for the electrons increases. Thus, Al^{3+} is smaller in size

652 **(c)**
Coordinate bonding involves sharing of an electron pair provided by a donor atom to acceptor atom.

653 **(c)**
It reflects trends in physical and chemical properties of the elements

654 **(d)**
Fluorine is the most electronegative element in the Periodic Table so it never shows positive oxidation state.

655 **(d)**
It is the definition of electron affinity.

656 **(c)**
XeF_4 has sp^3d^2-hybridized Xe atom having two lone pair of electrons and thus, octahedral geometry changes to square planar due to lone pair effect.

658 **(b)**
1 debye $= 10^{-18}$esu.

659 **(b)**
Smaller cation causes more polarization of anion.

660 **(b)**
Ionisation energy decreases down the group and increases along the period.

661 **(b)**
$Li^-: 1s^2, 2s^2$; $Be^-: 1s^2, 2s^2, 2p^1$; in Li, addition of electron has taken place in $2s$ orbital; in Be^-, addition of electron has taken place in $2p$ orbital loosing its $2s$ completely filled configuration.
EA_1 for Be is more positive than EA_1 for Li. Thus, Be^- is least stable.

662 **(b)**
It is the order of stability.

663 **(a)**
Small cation causes more polarization in anion. Also larger anions are easily polarized by a cation. More is polarization of anion, more is covalent character .

664 **(d)**
We know that ionisation potential gradually decreases on moving down the group while atomic size increases as we move down the group. Hence, larger the atomic size, smaller is ionisation potential.

665 **(a)**
$1s^2, 2s^2, 2p^6, 3s^1$configuration represents the Na, because the atomic number of Na is 11. The first ionisation energy is less than second ionisation energy because IE_2involves the removal of an electron from the stable configuration
$(i.e., 1s^2, 2s^2, 2p^6)$

666 **(d)**
$Be(OH)_2$ and $Zn(OH)_2$ are amphoteric in nature

667 **(b)**
Be has smallest size and thus, Be cation possesses more polarizing power.

668 **(c)**
No scope for addition in completely filled valence orbitals of inert gases.

669 **(a)**
As the s-character increases in hybrid orbitals, bond energy increases, size of the hybridized orbital decreases. s-characters in sp, sp^2 and sp^3 are 1/2,1/3,1/4 respectively.

670 **(a)**
Geometry is explained by taking an account of single bonds only. However, presence of double bond may distort bond angles, $e.g.$, HCHO has sp^2-hybridization but angle $H-C-H$ is 116° and angle $H-C-O$ is 122° due to double bond. In BF_3 (sp^2-hybridization) each angle is of 120°.

671 **(d)**
d^2sp^3- leads to octahedral geometry.

672 **(b)**

The ionisation potential increases in a period on moving left to right while in a group it is decreases on moving from top to bottom. Hence, Be has maximum ionisation potential.

674 **(a)**

Element	F	O	N	C
Electronegativity	4.0	3.5	3.1	2.5

∴ Correct order of electronegativity

F>O>N>C or F>N<O>C

675 **(a)**

Halogen	F_2	Cl_2	Br_2	I_2
Bond dissociation Energy (kJ mol^1)	158.8	242.6	192.8	151.1

The bond dissociation energy of F_2 is less than Cl_2 due to inter electronic repulsions present in small atom of fluorine.

The order of bond energy is $Cl_2 > F_2 > Br_2 > I_2$ and

Cl_2 has maximum bond energy.

676 **(b)**

SF_4 has sp^3d-hybridized sulphur atom.

677 **(a)**

A reason for given fact.

678 **(c)**

It is experimental value.

679 **(d)**

AgBr has higher lattice energy.

680 **(b)**

The size of isoelectronic species increases with decrease in effective nuclear charge.

681 **(b)**

O_2^{2-} has no unaired electron.

682 **(c)**

Na^+ and Cl^- are formed.

683 **(d)**

The K_{sp} value of CuS is less ZnS and thus, ZnS is more soluble. Also sodium salts are highly soluble in water.

684 **(b)**

These are isoelectronic species and their radii decreases with increasing their atomic number due to increasing effective nuclear charge (Z_{eff})

$(Z_{eff}) = Z - \sigma$

where, Z_{eff}=effective nuclear charge, Z=atomic number and σ =screening constant. For F^-, O^{2-} and N^{3-}, the value of σ is constant due to equal number of electrons. So, order of Z_{eff} is

$F^- < O^{2-} > N^{3-}$

hence, order of radii

$= F^- < O^{2-} < N^{3-} \left(\text{radii } \propto \frac{1}{Z_{eff}}\right)$.

685 **(c)**

Due to back bonding in BF_3.

686 **(b)**

CCl_4 involves two non-metals C and Cl and thus, bonding is covalent. CaH_2 is an ionic compound as it involves alkaline earth metal.

687 **(b)**

PF_5 has sp^3d hybridization (trigonal bipyramid); BrF_5 has sp^3d^2 hybridization (square pyramidal)

688 **(d)**

XeF_2 (sp^3d with 3 lone pairs) and CO_2(sp) are linear.

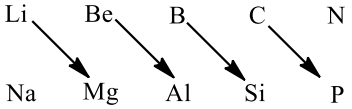
689 **(d)**

HF is least acidic due to the small size of fluorine

690 **(d)**

The element of II period show similar properties as the elements of III period, which are diagonally placed to them. This is known as diagonal relationship. Hence, Li shows diagonal relationship with Mg and Be shows diagonal relationship with Al.

IInd period



IIIrd period

691 **(c)**

In o-dichlorobenzene, $\alpha = 60°$

∴ $\cos\alpha$ = +ve,

$\mu = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2\cos\alpha}$

692 **(d)**

Cl possesses 10 electrons in ClF_3.

693 **(a)**

The ionisation potential increases from left to right in a period but the first ionisation potential of nitrogen is greater than oxygen due to half-filled stable configuration and ionisation potential of Be is greater than B due to completely filled s-orbital. Hence, the order of ionisation potential is as

Element :	B	<	Be	<	C	<	O	<	N
IP (eV) :	8.3		9.3		11.2		13.6		14.5

694 **(d)**

Mercury

695 **(a)**

Na − Cl. Both belongs to III period

696 **(d)**

Ionisation enthalpy increases along the period and decreases down the group

697 **(d)**

Ionisation energy order is $B < C < O < N$.

698 **(a)**

Acidic nature of oxide non-metallic nature of element. Non-metallic nature decreases in the order $Cl > S > P$.

699 **(c)**

Boron (B), Si, Ge, As, Sb, Te and At are the metalloid elements. Bismuth (Bi) and tin (Sn) are metals while carbon (C) is non-metal.

700 **(a)**

Xe in $XeOF_4$ has sp^3d^2-hybridization having one lone pair on Xe atom.

701 **(d)**

Fe is a transition element, thus exhibits variable oxidation states

702 **(b)**

Cs^+ is largest cation and F^- is smallest anion.

703 **(d)**

Ionic radius $\propto \frac{1}{Z_{\text{eff}}}$

Since, P^{5+} has higher Z_{eff} as compared to P^{3+}, it has smaller ionic radii

704 **(d)**

Isomerism is arised due to directional nature of covalent bonding.

705 **(d)**

Ionisation potential is the amount of energy requires to remove an electron from an isolated gaseous atom. Since, on moving down the group, the size of atom increases, thus outer electron gets farther and farther away from the nucleus and hence, the less amount of energy is required to remove it. Thus, ionisation potential decreases and hence, Cs has lowest ionisation potential.

706 **(a)**

A decrease in s-character increases bond length.

707 **(b)**

Both possess $1s^2, 2s^2 2p^6, 3s^2 3p^6$ configuration.

708 **(c)**

Na^+ is cation; Cl^-, PO_4^{3-} are anion.

709 **(a)**

Electronic configuration of element with atomic number 36, will be

$=1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^6$

As the last electron is present in p-subshell, hence the element will be placed in p-block.

710 **(c)**

Due to large electronegativity difference in C and F atoms.

711 **(b)**

According to Hannay and Smith equation

$\therefore$ % ionic character

$=16(x_A - x_B) + 3.5(x_A - x_B)^2$

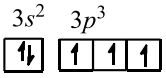
Where, x_A and x_B are the electronegative of the atoms A and B respectively.

$\therefore$ % ionic charecter $= 16(2) + 3.5(2)^2$

$=32+14=46\%$

712 **(b)**

[Ne] $3s^2\ 3p^3$



Elements having half-filled or fully-filled orbitals are more stable. Hence, much energy is required to remove an electron from the outermost orbit. So, [Ne] $3s^2 3p^3$ has highest ionisation energy.

713 **(d)**

Ionisation potential increases along the period.

714 **(b)**

Electron affinity is the energy change, when an electron is added. When O^- changes into O^{2-} the electron affinity is positive *i.e.*, change is endothermic. The reason is that O^- repels the incoming electron due to similar charge, hence, it needs energy to accept the electron. Hence, electron affinity is positive.

715 **(a)**

Like atoms results in covalent bonding leading to the formation of non-polar bond, $e.g.$, $H-H$ or H_2.

716 **(a)**

One of s-orbital $+3$ of p-orbital $= sp^3$.

717 **(b)**

Lower potential energy level imparts stability.

718 **(b)**

H-bonding in molecules gives rise to increase in b. p.

719 **(b)**

The jump in IP values exist in IP_5 and thus, removal of fifth electron occurs from inner shell. Thus, element contains four electrons in its valency shell.

720 **(a)**

The stability and bond angle order for hybrides in a group is

$NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$.

721 **(d)**

Size of anions is larger than their parent atoms. Also more is ENC lesser is size.

722 **(c)**
The difference of electronegativity is more.

723 **(c)**
Lattice energy of $BaSO_4$ is appreciable high and predominates over hydration energy.

725 **(b)**
Larger is bond order, lesser is bond length.

726 **(b)**
$o-, m-, p$-derivatives has $\alpha = 60°, 120°$ and $180°$ and thus, resultant vector has zero dipole moment in p-derivative. Also dipole moment of m-dichlorobenzene is more than toluene.

727 **(d)**
As the s character increases in hybridised orbitals, its electronegativity increases.

	sp	sp^2	sp^3
s character	50%	33.3%	25%

728 **(c)**
Polarity in a molecule gives rise to an increase in forces of attractions among molecules and thus, more becomes boiling point.

729 **(a)**
Ionisation energy increases with decrease in atomic size and decrease in shielding effect. Ten d-electrons in Ga shield the nuclear charge less effectively than the s and p electrons. Hence, the outer electron is held fairly strongly by the nucleus. Consequently, ionisation energy slightly increases inspite of the increase in atomic size from Al to Ga. Hence, Al (IE=577) and Ga(IE=578) have approximately equal ionisation potential (or ionisation energy).

730 **(b)**
Elements having six electrons in valency shell are electronegative elements, $e.g.$, O.

731 **(a)**
$BF_3(sp^2), NO_2^-(sp^2), NH_2^-(sp^3)$ and $H_2O(sp^3)$.

732 **(d)**
Effective nuclear charge increases in this order.

733 **(d)**
C_2H_2 is a linear molecule with sp-hybridization.

734 **(b)**
Double bond involves the sharing of two electron pairs or four electrons .

736 **(c)**
Multiplicity of bonds gives higher bond energy.

737 **(a)**
Inert pair effect is not noticed for elements having their outermost shell (n) if $n < 4$.

738 **(b)**
A characteristic of resonance.

739 **(c)**
Cl is more electronegative than I.

740 **(c)**
Due to sp^3-hybridization.

741 **(d)**
Bond energy for $C-C, N-N, H-H$ and $O-O$ are : $H-H > C-C > N-N > O-O$.

743 **(d)**
PCl_5 has trigonal bipyramid geometry.

744 **(b)**
Dry ice is CO_2 having $C-O$ covalent bonds.

745 **(c)**
Polar solute are more soluble in polar solvents .

746 **(c)**
Generally in a period, IE increases but nitrogen due to the presence of half-filled p-subshell (stable configuration) has higher IE as compared to its consecutive elements. Thus, the IE of nitrogen is 14.5

747 **(a)**
Zinc oxide is an amphoteric oxide as it reacts with both acid and alkali.

$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$

$ZnO + 2NaOH \rightarrow \underset{\text{sodium zincate}}{Na_2ZnO_2} + H_2O$

Rest all (Na_2O, CaO and BaO) are basic oxides.

748 **(a)**
Addition of electrons to an atom results an increase in its size.

749 **(a)**
Water is an universal solvent.

750 **(b)**
sp-hybridization leads to bond angle of 180°.

751 **(b)**
CsF is ionic compound .

752 **(a)**
Follow Fajan's rule.

753 **(b)**
37 is atomic number of Rb the electropositive element and 53 is atomic number of iodine (the electronegative element).

754 **(a)**
S atom in SF_6 is sp^3d^2-hybridized state and shows octahedral shape.

755 **(a)**
Except NO^-(16 electrons), rest all have 14 electrons.

756 **(d)**
F is more electronegative.

757 **(a)**
Molecular orbital configuration of,
$O_2^{2-} = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p^2, \pi 2p_x^2, \pi 2p_y^2, \pi^* 2p_z^2, \pi^* 2p_y^2$

758 **(c)**
Cl atom has 17 electrons, Cl^- ion has 18 electrons.

759 **(d)**
ClF_3 has sp^3d-hybridization with two lone pair of electron on Cl.

760 **(a)**
The ionisation energy values for valence electrons are comparable to remove electrons from inner shell very high amount of energy is needed. In the given values there is a biggest jump between $IE_4$and IE_5. Hence, there are four valence electrons for the atom X.

761 **(c)**
Hydrogen bonding is responsible for their solubility.

762 **(a)**
The tendency to show lower ionic state increases down the group due to inert pair effect.

763 **(d)**
Each has 18 electrons.

764 **(a)**
Each possesses 18 electrons.

765 **(b)**
The correct order of electron gain enthalpy (electron affinity) is $O < S < F < Cl$

Element	O	S	F	Cl
Electron affinity	1.48	2.07	3.45	3.61

In eV

766 **(d)**
CS_2 is linear having zero dipole moment.

767 **(c)**
Electronegativity increases in a period from left to right and decreases in a group on moving downwards

768 **(d)**
Electronic configuration of Cu is $1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^1, 3d^{10}$ and electronic configuration of Cu^{2+} is $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^9$. Hence, the given configuration represents metallic cation.

769 **(a)**
M.O. configuration of O_2^+ is:
$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2 \sigma 2p^2, \pi 2p_y^2 \pi 2p_y^2 \pi^* 2p_x^1$
Bond order of $O_2^+ = \frac{1}{2}[6-1] = \frac{5}{2}$
M.O. configuration of N_2^+ is:
$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2, \pi 2p_y^2 \pi 2p_y^2 \sigma 2p^1$
Bond order of $N_2^+ = \frac{1}{2}[5-0] = \frac{5}{2}$

770 **(a)**
SF_4 has sp^3d^2-hybridization and see-saw geometry.