Miscellaneous Exercise Question Bank

1. A molecule XY_2 contains two σ, two π bonds and one lone pair of electrons in the valence shell of X. The arrangement of lone pair as well as bond pairs is

(A) Square pyramidal **(B)** Linear

(C) Trigonal planar **(D)** Unpredictable

2. Among the following LiCl, $BeCl_2$, BCl_3, CCl_4 which will have the lowest melting point and the highest solubility in water.

(A) CCl_4, LiCl **(B)** LiCl, CCl_4 **(C)** $BeCl_2$, BCl_3 **(D)** BCl_3, $BeCl_2$

3. The correct order of polarizability is :

I^-, Br^-, Cl^-, F^-

(A) $I^- > Br^- > Cl^- > F^-$ **(B)** $I^- > Br^- = Cl^- > F^-$

(C) $I^- = Br^- = Cl^- > F^-$ **(D)** $I^- = Br^- < Cl^- = F^-$

4. The ionic conductance of which of the following is the highest?

(A) Li^+ (aq) **(B)** Na^+ (aq) **(C)** K^+ (aq) **(D)** Cs^+ (aq)

5. Highest covalent character is found in

(A) CaF_2 **(B)** $CaCl_2$ **(C)** $CaBr_2$ **(D)** CaI_2

6. The effect of hydrogen bonding is greatest in

(A) HF **(B)** NH_3 **(C)** CH_3NH_2 **(D)** H_2O

7. If Na^+ ion is larger than Mg^{2+} ion and S^{2-} ion is larger than Cl^- ion, which of the following will be more covalent?

(A) NaCl **(B)** Na_2S **(C)** $MgCl_2$ **(D)** MgS

8. The type of hybrid orbitals used by chlorine atom in ClO_2^- is

(A) sp^3 **(B)** sp^2 **(C)** sp **(D)** dsp^2

9. Which of the following has a net dipole moment?

(A) I_2Cl_6 **(B)** XeO_2F_4 **(C)** Al_2Cl_6 **(D)** PF_3Cl_2

10. As the s-character of hybridised orbital increases :

(A) the bond angle increases **(B)** the electronegativity increases

(C) the bond length decreases **(D)** All of the above

11. The type of bonds present in $CuSO_4.5H_2O$ are

(A) electrovalent, covalent and coordinate **(B)** electrovalent and covalent

(C) electrovalent and coordinate **(D)** covalent and coordinate

12. PCl_5 exists but NCl_5 does not because

(A) Nitrogen has no vacant 2 d- orbitals **(B)** NCl_5 is unstable

(C) Nitrogen atom is much smaller than P **(D)** Nitrogen is highly inert

13. Dipole moment is exhibited by

(A) 1, 4 – dichloro benzene **(B)** 1,2 – dichloro benzene

(C) 1, 3, 5 - trichlorobenzene **(D)** None of these

14. The pair of species having identical shape is

(A) CF_4, SF_4 **(B)** PCl_3, BF_3 **(C)** XeF_2, CO_2 **(D)** PF_5, IF_5

15. KF combines with HF to form KHF_2. The compound contains the species

(A) K^+, F^- & H^+ **(B)** K^+, F^- & HF **(C)** K^+ & $[HF_2]^-$ **(D)** $[KHF]^+$ & F^-

16. The hybridization of P in phosphate ion (PO_4^{3-}) is the same as in

(A) I in ICl_4^- **(B)** S in SO_3 **(C)** N in NO_3^- **(D)** S in SO_3^{2-}

17. Which ion has the highest polarising power?

(A) Mg^{2+} **(B)** Al^{3+} **(C)** Ca^{2+} **(D)** Na^+

18. The correct order of decreasing polarisability of ion is

(A) $P^{3-} < N^{3-}$ **(B)** $S^{2-} < O^{2-}$ **(C)** $Se^{2-} > S^{2-}$ **(D)** $F^- > I^-$

19. Which of the following is least ionic?

(A) AgCl **(B)** KCl **(C)** $BaCl_2$ **(D)** $CaCl_2$

20. Among the following molecules, N–Si bond length is shortest in :

(A) $N(SiH_3)_3$ **(B)** $NH(SiH_3)_2$

(C) $NH_2(SiH_3)$ **(D)** All have equal bond length

21. Molecular shapes of SF_4, CF_4 and XeF_4 are :

(A) Same with 2, 0 and 1 lone pairs of electrons respectively

(B) Same with 1, 1 and 1 lone pairs 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

22. The species having bent T-shape is :

(A) SCl_2 **(B)** SF_3^- **(C)** XeO_3 **(D)** BF_3

23. The valence electrons involved in formation of covalent bonds should be :

(A) paired **(B)** unpaired with same spin

(C) unpaired with opposite spin **(D)** in ground state

24. The amount of energy released when one mole of ionic solid is formed by close packing of gaseous ions is called :

(A) Ionisation energy **(B)** Solvation energy

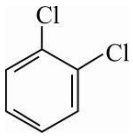
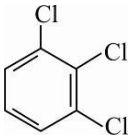
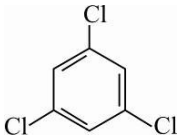
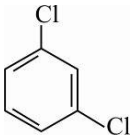
(C) Lattice energy **(D)** Hydration energy

25. Which is the correct sequence regarding the dipole moment of BF_3, NH_3 and NF_3 ?

(A) $BF_3 = NH_3 = NF_3$ **(B)** $BF_3 < NF_3 < NH_3$

(C) $NH_3 < BF_3 < NF_3$ **(D)** $NF_3 < BF_3 < NH_3$

26. Which of the following has least dipole moment ?

(A)  **(B)**  **(C)**  **(D)** 

27. The electronegativity difference between two elements A and B is 0.2 The magnitude of percentage ionic character in single A – B bond would be :

(A) 4.45 **(B)** 3.34 **(C)** 17.8 **(D)** 26.7

28. Which of the following species is/are paramagnetic NO_2, NO, N_2O_4, N_2O_5 ?

(A) Only NO_2 **(B)** NO_2, NO **(C)** NO, NO_2, N_2O_5 **(D)** All are paramagnetic

29. Bond order of CO_3^{2-} species is :

(A) 1.5 **(B)** 1.33 **(C)** 1.75 **(D)** 1.25

30. Paramagnetism is not shown by :

(A) O_2^- **(B)** H_2^+ **(C)** O_2 **(D)** O_2^{2-}

31. The order of increasing bond length in F_2, Cl_2, N_2 and O_2 is :

(A) N_2, O_2 , Cl_2, F_2 **(B)** N_2 , O_2 , F_2, Cl_2

(C) O_2 , N_2 , Cl_2, F_2 **(D)** N_2, Cl_2, O_2 , F_2

32. Among the four molecules, HF, CH_4, CH_3OH and N_2O_4, intermolecular hydrogen bonding is expected :

(A) In all the molecules **(B)** In all expect one molecule

(C) In two of the molecules **(D)** In none of the molecules

33. For resonance structure a molecule may not have :

(A) Identical arrangement of atoms **(B)** Nearly same energy contents

(C) The same number of paired electrons **(D)** Identical bonding

34. The non-linear structure is assumed by :

(A) $SnCl_2$ **(B)** NCO^- **(C)** NO_2^+ **(D)** CS_2

35. The bonds present in N_2O_5 are :

(A) only ionic **(B)** covalent and coordinate

(C) only covalent **(D)** covalent and ionic

36. The geometric form of crystals is the result of orderly arrangement of :

(A) molecules only **(B)** ions only **(C)** atoms only **(D)** any of the above

37. Number of water molecules directly attached to one water molecule is:

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

38. The bond order in O_2^+ is the same as in

(A) N_2^+ **(B)** CN^- **(C)** CO **(D)** NO^+

39. 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^{2-}, N_2

40. Intramolecular H–bonding is present in

(A) o–nitrophenol **(B)** Salicylaldehyde **(C)** m–nitrophenol **(D)** Both (A) and (B)

41. Which of the following statements is correct for NO_3^- ion?

(A) Sum of the formal charges = +1 **(B)** Formal charge on one of the oxygen atom = –2

(C) Formal charge on nitrogen atom = +1 **(D)** Average formal charge on oxygen atom = $-\frac{1}{3}$

42. An electrovalent compound does not exhibit space isomerism because of :

(A) Presence of oppositively charged ions **(B)** High melting points

(C) Non-directional nature of the bond **(D)** Crystalline nature

43. Two elements A and B have following electronic configuration.

$A = 1s^2\ 2s^2 2p^6 3s^2$

$B = 1s^2 2s^2 2p^6 3s^2 3p^3$

If expected compound formed by A and B is A_xB_y then sum of x and y is :

(A) 2 **(B)** 3 **(C)** 4 **(D)** 5

44. In which of the following ionic compounds, ΔH_f is negative only due to lattice energy?

(i) NaF **(ii)** MgO **(iii)** Li_3N **(iv)** Na_2S

(A) Only (iv) **(B)** Only (iii), (iv)

(C) Only (ii), (iii), (iv) **(D)** All of these

45. Which of the following is an example of super octet molecule?

(A) ClF_3 **(B)** PCl_5 **(C)** IF_7 **(D)** All the three

46. Which bond is expected to be the least polar?

(A) O — F **(B)** P — F **(C)** Si — N **(D)** B — F

47. Which of the following overlaps gives σ – bond along x – axis as internuclear axis?

(A) p_z and p_z **(B)** s and p_z **(C)** s and p_y **(D)** $d_{x^2-y^2}$ and $d_{x^2-y^2}$

48. Give the correct order of initials T or F for following statements. Use T if statement is true and F if it is false:

(I) The order of repulsion between different pair of electrons is $l_p - l_p > l_p - b_p > b_p - b_p$

(II) In general, as the number of lone pair of electrons on central atom increases, value of bond angle from normal bond angle also increases

(III) The number of lone pair of electrons on O in H_2O is 2 while on N in NH_3 is 1

(IV) The structure of xenon fluorides and xenon oxyfluorides could not be explained on the basis of VSEPR theory

(A) TTTF **(B)** TFTF **(C)** TFTT **(D)** TFFF

49. Which of the following compounds is planar and non-polar?

(A) XeO_4 **(B)** SF_4 **(C)** XeF_4 **(D)** CF_4

50. Low melting point is expected for :

(A) Ionic solid **(B)** Metallic solid **(C)** Molecular solid **(D)** Covalent solid

51. Which substance has the highest melting point?

(A) CO **(B)** CO_2 **(C)** SiO_2 **(D)** P_2O_5

52. Carbon dioxide is gas, while SiO_2 is solid at room temperature because:

(A) CO_2 is a linear molecule, while SiO_2 is angular

(B) van der Waals' forces are very strong in SiO_2

(C) CO_2 is covalent, while SiO_2 is ionic

(D) Si cannot form stable bonds with O, hence Si has to form a 3D lattice

53. In protonation of H_2O , change occur in :

(A) Hybridisation state of oxygen atom **(B)** Shape of molecule

(C) Hybridisation and shape both **(D)** None of these

54. The correct order of 'S—O' bond length is:

(A) $SO_3^{2-} > SO_4^{2-} > SO_3 > SO_2$ **(B)** $SO_3^{2-} > SO_4^{2-} > SO_2 > SO_3$

(C) $SO_4^{2-} > SO_3^{2-} > SO_2 > SO_3$ **(D)** $SO_4^{2-} > SO_3^{2-} > SO_3 > SO_2$

55. A molecule may be represented by three structures having energies E_1, E_2 and E_3 respectively. The energies of these structures follow the order $E_3 < E_2 < E_1$. If the experimental bond energy of the molecule is E_0 , the resonance energy is :

(A) $(E_1 + E_2 + E_3) - E_0$ **(B)** $E_0 - E_3$

(C) $E_0 - E_1$ **(D)** $E_0 - E_2$

56. Resonance structures can be written for :

(A) O_3 **(B)** NH_3 **(C)** CH_4 **(D)** H_2O

57. The shapes of nitrite and nitrile respectively are :

(A) Linear and angular **(B)** Angular and linear

(C) Both angular **(D)** Both linear

58. $\angle$FAsF bond angle in AsF_3Cl_2 molecule is :

(A) 90° and 180° **(B)** 120° **(C)** 90° **(D)** 180°

59. The stability of ionic crystal principally depends on :

(A) high electron affinity of anion forming species

(B) the lattice energy of crystal

(C) low I.E. of cation forming species

(D) low heat of sublimation of cation forming solid

60. Which one is correct for bond angle?

(A) $PF_3 > PCl_3$ **(B)** $OCl_2 = ClO_2$ **(C)** $NF_3 > NH_3$ **(D)** $PCl_3 > PF_3$

***61.** Which of the following statements is/are incorrect?

(A) Bond order can never be fractional

(B) When bond order is $\frac{1}{2}$ species exists but is unstable

(C) Bond order in CO is 3

(D) Greater the bond order lesser is the bond dissociation energy

62. Which is distilled first?

(A) Liquid H_2 **(B)** Liquid CO_2 **(C)** Liquid O_2 **(D)** Liquid N_2

63. The molecule which possesses both sp^3 and sp^3d^2 hybridisation is :

(A) Solid PCl_5 **(B)** Gaseous PCl_5 **(C)** PCl_4^+ **(D)** PCl_6^-

64. There is no S – S bond in :

(A) $S_2O_4^{2-}$ **(B)** $S_2O_6^{2-}$ **(C)** $S_2O_3^{2-}$ **(D)** $S_2O_7^{2-}$

65. Which of the following compounds of Group IV elements would you expect to be most ionic in character?

(A) CF_4 **(B)** SiO_2 **(C)** SiC **(D)** PbF_2

66. In forming (i) $N_2 \rightarrow N_2^+$ and (ii) $O_2 \rightarrow O_2^+$; the electrons respectively are removed from

(A) $\left(\pi^*2p_y \text{ or } \pi^*2p_x\right)$ and $\left(\pi^*2p_y \text{ or } \pi^*2p_x\right)$ **(B)** $\left(\pi 2p_y \text{ or } \pi 2p_x\right)$ and $\left(\pi 2p_y \text{ or } \pi 2p_x\right)$

(C) $\left(\sigma 2p_z\right)$and $\left(\pi^*2p_y \text{ or } \pi^*2p_x\right)$ **(D)** $\left(\pi^*2p_y \text{ or } \pi^*2p_x\right)$ and $\left(\pi 2p_y \text{ or } \pi 2p_x\right)$

67. N_2 and O_2 are converted into N_2^+ and O_2^+ respectively.

Which of the following is not correct?

(A) In N_2^+, the N – N bond weakens **(B)** In O_2^+, O – O bond order increases

(C) In O_2^+, paramagnetism decreases **(D)** N_2^+ becomes diamagnetic

68. In which of the following molecular species both types of dative bonds (σ and π) are present?

(A) BF_4^- ? **(B)** Be_2Cl_4 **(C)** NH_4^+ **(D)** $\left[BeF_4\right]^{2-}$

69. The fluorine molecule is formed by :

(A) p – p orbitals (sideways overlap) **(B)** p – p orbitals (end-to-end overlap)

(C) sp – sp orbitals **(D)** s – s orbitals

70. Number of S — S bonds is $H_2S_nO_6$:

(A) n **(B)** (n – 1) **(C)** (n – 2) **(D)** (n + 1)

***71.** Which of the following statements are correct about sulphur hexafluoride?

(A) all S — F bonds are equivalent

(B) SF_6 is a planar moelcule

(C) oxidation number of sulphur is the same as number of electrons of sulphur involved in bonding

(D) sulphur has acquired the electronic structure of the gas argon

***72.** Most ionic compounds have

(A) high melting points and low boiling points

(B) high melting points and non-directional bonds

(C) high solubilities in polar solvents and low solubilities in non-polar solvents

(D) three-dimensional network structures, and are good conductors of electricity in the molten state.

***73.** To which of the following species is the octet rule not applicable?

(A) BrF_3 **(B)** SF_6 **(C)** IF_7 **(D)** CO

***74.** Which of the following species have π bonds according to MOT ?

(A) B_2 **(B)** C_2 **(C)** O_2^{4-} **(D)** HF

***75.** Bond angle in PH_3 is :

(A) much less than NH_3 **(B)** much less than PF_3

(C) slightly more than NH_3 **(D)** much more than PF_3

***76.** Which one or more among the following involve(s) p_π - d_π bonding?

(A) $(SiH_3)_3N$: **(B)** $(CH_3)_3N$: **(C)** $:\overset{\ominus}{C}Cl_3$ **(D)** $:\overset{\ominus}{C}F_3$

***77.** Which of the following has fractional bond order?

(A) O_2^- **(B)** NO **(C)** CO_3^{2-} **(D)** CO_2

***78.** The molecule having one unpaired electron is :

(A) NO **(B)** B_2 **(C)** NO_2 **(D)** O_2

***79.** Which of the following arrangement correctly represent the decreasing order of bond angles ?

(A) $NH_3 > PH_3 > AsH_3$ **(B)** $NH_3 > H_2O > F_2O$

(C) $NO_2^+ > NO_2^- > NO_2$ **(D)** $CH_4 > NH_3 > H_2O$

***80.** Select the correct statements:

(A) the heat of hydration of the dipositive alkaline earth metals ions decrease with an increase in their ionic size.

(B) hydration of alkali metal ions is less than that of IIA

(C) alkaline earth metal ions, because of their much larger charge to size ratio exert a much stronger electrostatic attraction on the oxygen of water molecule surrounding them.

(D) melting point of sodium halides follow order
NaF > NaCl > NaBr > NaI

***81.** Which of the following molecules have intermolecular hydrogen bonds?

(A) KH_2PO_4 **(B)** H_3BO_3 **(C)** $C_6H_5CO_2H$ **(D)** CH_3OH

***82.** $C_6H_5CO_2H$ forms a dimer in benzene solution because

(A) of molecular association in benzene which occurs through the intermolecular hydrogen bond

(B) of the strong van der Waals force between two molecules of $C_6H_5CO_2H$

(C) a pair of carboxylic acid molecules are held by two hydrogen bonds

(D) none of these

***83.** If AB_4^n, types species are tetrahedral, then which of the following is/are correctly matched? (Where A is central atom, B is surrounding atom and n is charge on species).

	A	**B**	**n**
(A)	Xe	O	0
(B)	Se	F	0
(C)	P	O	–3
(D)	N	H	+1

***84.** Which of the following combinations of orbitals do/does not form bond (if x-axis is internuclear axis)?

(A) $s + p_z$ **(B)** $s + s$ **(C)** $p_z + p_x$ **(D)** $d_{xy} + p_y$

***85.** Which pair(s) can form 'XY' type compound?

(A) Al, P **(B)** Mg, N **(C)** Ca, O **(D)** Na, F

	Assertion (column – I)	**Reason (column – II)**
86.	Na_2SO_4 is soluble in water while $BaSO_4$ is insoluble.	Lattice energy of $BaSO_4$ is higher than its hydration energy.

Use the following key to choose the appropriate answer.

(A) If both assertion and reason are correct, and reason is the correct explanation of the assertion.
(B) If both assertion and reason are correct, but reason is not the correct explanation of the assertion.
(C) If assertion is correct, but reason is incorrect.
(D) If assertion is incorrect, but reason is correct.

87. Among LiCl, $BeCl_2$, BCl_3 & 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)** $LiCl < BeCl_2 < BCl_3 > CCl_4$

Column-I and Column-II contains four entries each. Entries of Column-I are to be matched with some entries of Column-II. One or more than one entries of Column-I may have the matching with the same entries of Column-II.

88. Match column I (species) with column II (Hybridisation) and select the correct answer using the codes given below.

Column-I		**Column-II**	
(A)	BCl_3	**(P)**	sp^3
(B)	NH_3	**(Q)**	sp^3d^2
(C)	PCl_5	**(R)**	sp^2
(D)	XeF_4	**(S)**	sp^3d

89. Match the column:

Column-I (Bond order range)		**Column-II (Oxyanions)**	
(A)	1.0 to 1.30	**(P)**	NO_3^-
(B)	1.31 to 1.55	**(Q)**	ClO_4^-
(C)	1.56 to 1.70	**(R)**	PO_4^{3-}
(D)	1.71 to 2.0	**(S)**	ClO_3^-
		(T)	SO_4^{2-}

90. Match the column:

Column-I		Column-II	
(A)	$B_3N_3H_6$	**(P)**	Planar geometry
(B)	I_3^-	**(Q)**	Non-planar geometry
(C)	B_2Cl_4 (Solid)	**(R)**	Compound having coordinate bond
(D)	SiF_4	**(S)**	Compound having back bond
		(T)	Non-polar compound

91. Match the column:

Column-I (Axial/sideways combination of appropriate/inappropriate pure orbitals)		Column-II (Types of molecular orbital)	
(A)	p + p pure orbitals	**(P)**	σ – bonding molecular orbital
(B)	s + p pure orbitals	**(Q)**	π – anti-bonding molecular orbital
(C)	(non-axial) d + p pure orbitals	**(R)**	σ – anti-bonding molecular orbital
(D)	(axial) d + p pure orbitals	**(S)**	π – bonding molecular orbital
		(T)	Non-bonding molecular orbital

Paragraph for Question No. 92 - 94

According to V.B.T., atoms of element form bond only to pair up their unpaired electrons present in ground state or excited state. This pairing of unpaired electron will take place by overlapping of orbitals each one having one unpaired electron with opposite spin.

92. Which of the following orbital combinations does not form π – bond ?

(A) $p_x + p_x$ sideways overlapping **(B)** $d_{z^2} + p_y$ sideways overlapping

(C) $d_{xy} + d_{xy}$ sideways overlapping **(D)** $d_{yz} + p_y$ sideways overlapping

93. Which of the following orbitals can form σ – bond ? (z-axis is internuclear axis)

(A) p_x orbital **(B)** p_y orbital **(C)** d_{z^2} orbital **(D)** d_{zx} orbital

94. Which of the following combination of orbitals does not form any type of covalent bond (If z-axis is molecular axis)?

(A) $p_z + p_z$ **(B)** $p_y + p_y$ **(C)** $d_{z^2} + d_{xy}$ **(D)** $s + s$

Paragraph for Question No. 95 - 97

According to VBT the extent of overlapping depends upon types of orbitals involved in overlapping and nature of overlapping. More will be the overlapping, higher will be the bond energy.

95. The incorrect order of bond dissociation energy will be:

(A) H — H > Cl — Cl > Br — Br **(B)** Si — Si > P — P > Cl — Cl

(C) C — C > N — N > O — O **(D)** H — Cl > H — Br > H — I

96. Which of the following combinations of orbitals does not form covalent bond (x-axis is inter nuclear axis):

(A) $s + p_y$ **(B)** $p_y + p_y$ **(C)** $d_{yz} + d_{yz}$ **(D)** $d_{xy} + d_{xy}$

97. Which of the following compounds does not contain $p\pi - p\pi$ bond?

(A) SO_3 **(B)** NO_3^- **(C)** SO_4^{2-} **(D)** CO_3^{2-}

Paragraph for Question No. 98 - 100

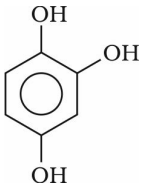
The intermolecular forces of attraction (i.e. H-bonding and van der Waals' forces) exist among polar and non-polar species which affect melting point, boiling point, solubility and viscosity of covalent compounds :

98. Melting and boiling point of halogens increase down the group due to :

(A) Increase in London forces **(B)** Increase in extent of polarity

(C) Increase in molecular mass **(D)** Both (A) and (C)

99. The type of molecular force of attraction present in the following compound is :



(A) Intermolecular H-bonding **(B)** Intramolecular H-bonding

(C) Van der Waals' force **(D)** All of these

100. Select the incorrect order of boiling point between the following compounds :

(A) $N_3H < CH_3N_3$ **(B)** $Me_2SO_4 < H_2SO_4$

(C) $Me_3BO_3 < B(OH)_3$ **(D)** $BF_3 < Bl_3$