2 Structure and Bonds

2.1 Primary interaction.

1) The bond in between two atoms becomes ionic,
1) who two atoms shear, one or more pair of electrons.
2) when two atom are kept together by static electric forces due to electrons.
3) when one or more electrons from one atom is given to the other atom.
4) when two atoms exchange their electrons.
5) when the two atoms are held together by nucleic forces. (1981)

2)

Metals have very high heat and electric conductivities.	Since metals ionized easily. (1982)

3) The true statement /s regarding ionic and covalent compounds is/are
a) Covalent compounds never exhibit very high boiling points.
b) The more electropositive atoms in a covalent molecule always gain the noble gas electronic configuration.
c) The most electronegative atom in an ionic compound always gain the noble gas electronic configuration.
d) Without any contribution from metals, non metals form ionic compounds. (1988)

4) Metals are good conductors as,
1) Metals are electropositive
2) Metals have a large number of electrons.
3) Metals have a lower electron affinity.
4) Metals have a mobiles electrons.
5) Metals have an ionic lattice inside them. (1989)

5) The formula of the oxide that shows the highest oxidation stats formed from atomic number 41 is,
1) M_2O_3 2) MO_2 3) M_2O_5 4) MO_3 5) M_2O_7 (1990)

6) Which bond has the maximum ionic characteristics?
1) H – H 2) F – F 3) Cl – Br 4) N – H 5) O – H (1990)

7)

Liquid HF conducts electricity very well	The electronegatively difference between H and F is high (1996)

8) Which one of the following compounds has the highest ionic character?
1) LiCl 2) HF 3) LiBr 4) RbCl 5) HI (1997)

9)

The specific heat capacity of liquid water is anomalously high	In liquid water strong interaction occur between H_2O molecules (1997)

10) The molecules $(CH_3)_3P$ and $AlCl_3$ form a coordinates compound in the mole ratio of 1 : 1. In this compound the bond between the P atom and the Al atom,
1) can be shown as P = Al
2) can be shown as $P^+ = Al^-$
3) can be shown as $P^- = Al^+$
4) can be shown as P ← Al
5) can be shown as P → Al
(1998)

11) In the valence shell of the Si atom in the $[SiF_6]^{2-}$ atom, there are,
1) 2 electrons 2) 4 electrons 3) 6 electrons 4) 10 electrons 5) 12 electrons

12) Which of the following statements concerning the process of the formation of the bond between BF_3 and $N(CH_3)_3$ are / is true ?
(a) It could be assumed that initially an electron is temperately transferred from the N atom to the B atom
(b) It could be assumed that initially an electron is temperately transferred from the B atom to the N atom
(c) The B atom supplies a pair of electrons for the ionization of the bond
(d) the N atom supplies a pair of electron for the formation of the bond (1999)

13) The element most likely to form a diatomic molecule in the gaseous state is,
1) Ne 2) Zn 3) Na 4) Ca 5) Ar (2000)

14) The products of dissociation of HOBr are most unlikely to be,
1) H^+ and OBr^- 2) OH^- and Br^+ 3) HO^+ and Br^-
4) HO and Br 5) H and OBr (2002)

15) The electronic configuration of the valence shell of the element that has the least tendency to form a diatomic molecule is,
1) s^1p^0 2) s^2p^0 3) s^2p^3 4) s^2p^4 5) s^2p^5 (2002)

16) Which one of the following would represent the formation of covalent bonds ?
1) A non metal taking electrons from a metal
2) A non metal taking electrons from another non metal
3) A metal giving a pair of electrons to a non metal
4) A non metal giving a pair of electron to a metal
5) A metal and non metal sharing electrons (2002)

17) The element Z has the electronic configuration $...ns^2\ np^3$
The electronic configuration of the element that from the most covalent bond with Z is,
1) $...ns^2\ np^1$ 2) $...ns^2\ np^2$ 3) $...ns^2\ np^3$ 4) $...ns^2\ np^4$ 5) $...ns^2\ np^5$ (2003)

18) Atoms of four different elements A, B, C and D have electro negativities as follows,
A = 3.8 B = 3.3 C = 2.8 D = 1.3
If these elements form the molecules AB, AD, BD and AC the order of increasing covalent character in these molecules is,
1) BD < AC < AB < AD 2) AD < BD < AC < AB 3) AB < AC < BD < AD
4) AC < BD < AB < AD 5) AD < BD < AB < AC (2003)

19) Which of the following statement(s) is/ are true regarding the formation of a stable chemical bond ?
(a) In involving the overlap of an orbital having one electron with another orbital having one electron
(b) In involving the overlap of an orbital having two electron with another orbital having two electron
(c) In involving the overlap of an orbital having two electron with another orbital without any electron
(d) Lateral overlap of orbitals produce π–bonds (2003)

20)	PCl_5 exists but NCl_5 does not	The phosphorus atom is lager than the nitrogen atom. (2003)
21)	The properties of one N – H bond in the NH_4^+ ion are different from those of the other three N – H bonds.	One N – H bond in the NH_4^+ ion can be identified as a co-ordinate bond. (2005)

22) The electronic configuration of the element (X) that forms a diatomic (X_2) with the highest bond energy is,

1) $1s^2\ 2s^2\ 2p^6\ 3s^1$ 2) $1s^2\ 2s^2\ 2p^4$ 3) $1s^2\ 2s^2\ 2p^3$
4) $1s^2\ 2s^2\ 2p^1$ 5) $1s^2\ 2s^2\ 2p^2$ (2009)

23) Which of the following statements is/ are true about metals ?

(a) They conduct electricity.
(b) The density of all metals is higher than that of water.
(c) The react with dilute acids always liberating H_2 gas
(d) Majority of the elements are metals. (2009)

24)	LiF has more covalent character than LiF.	When the cation is small and / or has a high charge, it has a high polarization power. (2011)

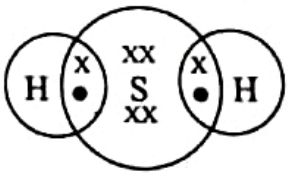
2.2 Geometrical arrangements of molecules and ions.

1)	CO_2 molecule is angular shape.	Since as C atom has two single electron paires. (1980)

2) The shape of $BeCl_2$ is,

1) Planar 2) Angular 3) Triangular 4) Linear
5) Non of the above (1981)

3) The diagram showing valence electron in H_2S molecule is given below. Expressed by this is,



(a) Sulphur can exhibit only 2 and 4 valancies.
(b) The total number of electron in the molecule.
(c) The number of bonded electrons in hydrogen.
(d) The number of bonded electrons in sulphur. (1981)

4) The arrangement of atoms connected to nitrogen atom in the complex molecule BCl_3NCl_3 is,

1) Planar 2) Distorted Tetrahedral 3) Octahedral
4) Distorted octahedral 5) None of the above (1981)

5) The shape of PCl^-_6 is,

1) Trigonal bipyramidal 2) Distorted Tetrahedral geometry
3) Octahedral 4) Hexagonal 5) None of the above (1981)

6) The number of pairs valance electrons around the central atom of BCl_3 is,

1) 8 2) 4 3) 3 4) 6 5) None of the above (1982)

7) | BF_3 molecule has a similar shape to NH_3 | Both NH_3 and BCl_3 have equal number of pairs of bonded electrons. (1982) |

8) The molecule that has the pyramidal shape is,
1) water 2) Ammonia 3) Berallium chloride
4) Carbon tetrachloride 5) Boron trichloride (1983)

9) The shape of the H_2S molecule is,
1) Linear 2) Angular 3) Tetrahedral
4) Triangular 5) None of the above (1985)

10) The true statement regarding BF_4^- anion is,
1) It is planar 2) It is tetrahedral 3) It is trigonal bipyramidal
4) It is octahedral 5) None of the above (1987)

11) The shape of the cationic species PCl^+_4 is
1) Planar 2) trigonal pyamidal 3) trigonal bipyramidal
4) tetrahedral 5) none of the above (1991)

12) | H_3O^+ is planar | There are three O – H bonds in H_3O^+ (1992) |

13) The shape of the cationic species PCl^+_4 is
1) Planar 2) trigonal pyamidal 3) trigonal bipyramidal
4) tetrahedral 5) none of the above (1993)

14) | The PF_3 molecule is planar | In PF_3 phosphorus is trivalent (1994) |

15) The shape of the species PF_4^+ is,
1) planar 2) square palanar 3) tetrahedral
4) trigonal bipyramidal 5) none of the above (1996)

16) The shape of the POClBrF molecule
1) is planar 2) takes the form of a square pyramid 3& is octahedral
4) is tetrahedral 5) is trigonal bipyramidal (1997)

17) Which one of the following statements concerning the shape of the ClO_3^- anion is most appropriate ?
1) It is tetrahedral 2) It is planar
3) It takes the shape of the letter 'T' 4) It is trigonal pyramidal
5) It has the shape of the SO_3 molecule (1998)

18) Which one of the following species has a shape that shows close simillaries to the shape of the ammonia molecule ?
1) SO_3 2) $SOCl_2$ 3) $COCl_2$ 4) CO_3 5) BF_3 (1999)

19) Which of the following statements/ statement concerning atomic orbitals are / is true ?
a) On overlap of two p - orbital, a π - bond is always formed
b) On overlap of an s - orbital, a p - orbital, a σ - bond is a π - bond can be formed
c) On overlap of two s - orbitals, a σ - bond is always formed
d) s and p - orbitals taking part in hybridization should belong to the same atom'
(2000)

20) Which of the following statement(s) is/ are true about the nitronium ion (NO_2^+) ?
(a) It is linear in shape (b) There are only σ bonds
(c) It is angular in shape (d) valence shell of N has less than 8 electrons (2001)

21) Consider the following molecule

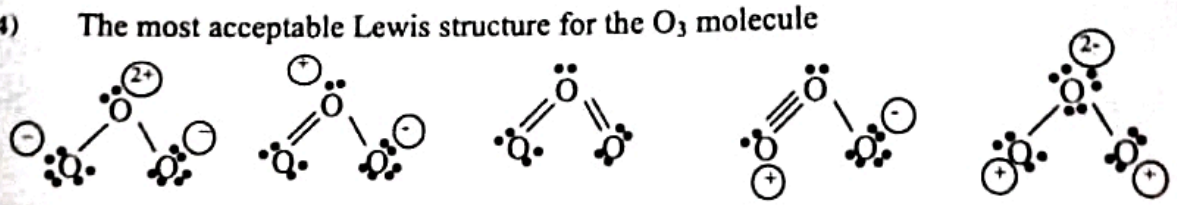
$$H_2C^v = C^w(C^xH_3)\ C^y \equiv C^zH$$

The superscripts v, w, x, y and z are used to label the C atoms'
Which of the following statement(s) is / are true?
(a) $C^y\ C^w\ C^x$ angle is approximately 120^o
(b) All the C atoms of this molecule lie on the same plane.
(c) All the H atoms this molecule lie on the same plane.
(d) The carbon atoms C^v, C^w, C^y and C^z lie on a straight line. (2001)

22) SO_4^{2} The ion/ molecule which has a shape significantly different from the SO_4^{2-} ion is,
1) NH_4^+ 2) BCl_4^- 3) SF_4 4) $S_2O_3^{2-}$ 5) CH_4 (2002)

23) The molecule that has a shape similar to that of ion ICl_2^- is,
1) SO_2 2) O_3 3) $BeCl_2$ 4) H_2S 5) HOCl (2003)

24) The most acceptable Lewis structure for the O_3 molecule



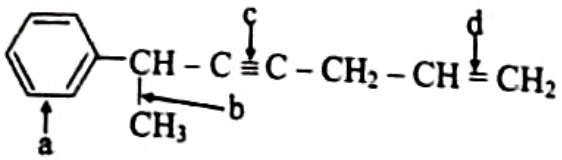
1) 2) 3) 4) 5) (2003)

25) Noble gas xenon forms a covalent compound XeF_4 . The likely geometry of XeF_4 is,
1) tetrahedral 2) square planar 3) octahedral
4) trigonal pyramid 5) see-saw (2003)

26) The molecule ion that has a shape different to that of the PO_4^{3-} ion is,
1) $POCl_3$ 2) $SiCl_4$ 3) CH_4 4) ICl_4^- 5) SO_4^{2-} (2004)

27) Which of the following molecules has four atoms in a single phase ?
1) SF_4 2) BCl_3 3) PCl_3 4) NH_3 5) SiH_4 (2004)

28)



Which arrangement gives the correct increasing order of bond lengths, of the bonds labelled a, b, c and d in the following molecule?
1) a < b < c < d 2) a < c < b < d 3) c < a < d < b
4) c < d < a < b 5) d < c < b < a (2004)

29)

ICl_2^- and NO_2 are both linear in shape	Molecules/ ions that have the same number of atoms generally have the same shape (2004)

30) The valency and oxidation number of the central atom in $S_2O_3^{2-}$ ion are respectively.
1) 2 and +4 2) 4 and +6 3) 6 and +4 4) 6 and +2 5) 4 and +4 (2005)

31) The shape of the BrF_5 molecule is
1) trigonal bipyramidal 2) octahedral 3) square pyramidal
4) tetrahedral 5) none of these (2005)

32) For the species NO_2, NO_2^- and NO_2^+ the correct order of the bond angles is,
1) $NO_2 > NO_2^- > NO_2^+$ 2) $NO_2^+ > NO_2 > NO_2^-$ 3) $NO_2^- > NO_2 = NO_2^+$
4) $NO_2^- > NO_2^+ > NO_2$ 5) $NO_2^+ > NO_2^- > NO_2$ (2005)

33) Of those given below, the possible combination of bonds that can be formed between any two atoms is
1) two σ bonds and one π bond. 2) one σ bond and one π bond.
3) one σ bond and one π bond. 4) three π bonds.
5) two σ bonds (2005)

34)

ICl_4^- ion is tetrahedral.	There are four repulsion units around the iodine atom in ICl_4^- (2005)

35) Which one of the following pairs contains species with different shapes?
1) CO_2, $BeCl_2$ 2) PO_4^{3-}, $S_2O_3^{2-}$ 3) NO_3^-, SO_3^-
4) HOBr. H_2S 5) NCl_3, BCl_3 (2006)

36) The arrangement of electron pairs around Sb atom in SbF_4^{2-} is,
1) octahedral. 2) square pyramidal. 3) trigonal bipyramidal.
4) square planar. 5) pentagonal pyramidal. (2007)

37) In which of the following do the two molecules have an unpaired electron each?
1) SO_2 and NO 2) NO and CO 3) NO_2 and N_2O 4) SO_2 and NO_2
(2007)

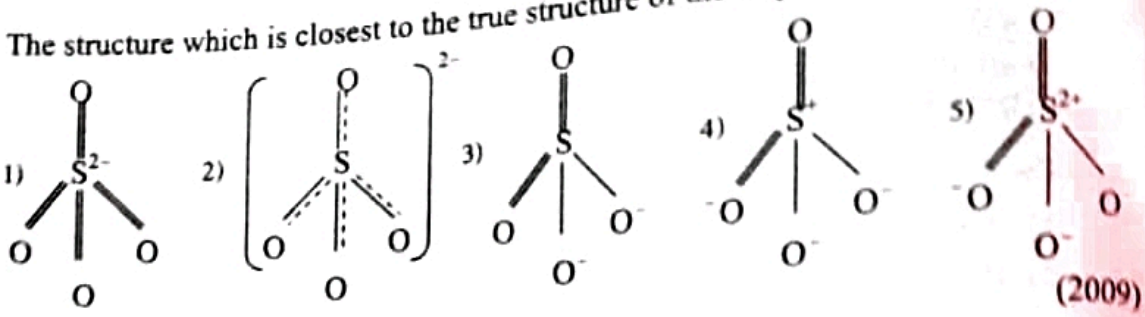
38)

Each bond angle in the molecule.  is equal to 109.5θ°	The carbon atom in this molecule is sp^3 hybridised. (2007)

39) Of the molecules/ions given below, which one has a shape different from the shape of the others?
1) SO_4^{2-} 2) $S_2O_3^{2-}$ 3) PCl_4^+ 4) NH_4^+ 5) SF_4 (2008)

40) Among the following the molecules/ ions having the shape are,
(A) NH_3 (B) H_3O^+ (C) ClF_3 (D) BCl_3 (E) PCl_3
1) A and C 2) C and D 3) A, B and E
4) C, D and E 5) B and C (2009)

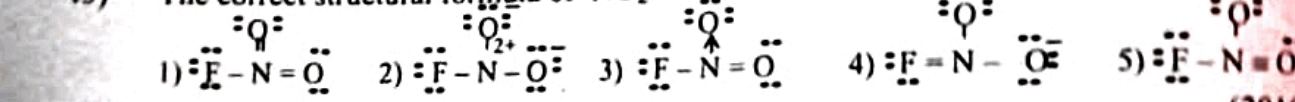
41) The structure which is closest to the true structure of the sulphate ion is,



(2009)

42) Identify the molecule or ion from those given below whose shape is distinctly different from that of SO_3^{2-} ion,
1) ClO_3^- 2) PCl_3 3) $SOCl_2$ 4) H_3O^+ 5) NO_3^- (2010)

43) The correct structural formula of NO_2F is,



(2010)

44) Which row of the following table gives the correct information with regard to the NSF molecule?

	Oxidation state of S	Charge on S	Hybridization of S	NSF bond angle	Nature of S – F bond
(1)	-4	-2	sp	180°	S(sp h.o) – F(2p a.o)
(2)	-1	-1	sp^2	< 120°	S(sp^2h.o) – F(2p a.o)
(3)	0	+1	sp^2	> 120°	S(sp^2h.o) – F(2p a.o)
(4)	+1	0	sp^3	90°	S(sp^3h.o) – F(2p a.o)
(5)	+4	0	sp^2	between 90°-120°	S(sp^2h.o) – F(2p a.o)

(h.o = hybrid orbital a .o = atomic orbital) (2012N)

45) The molecular shape and electron pair geometry of $XeOF_4$ are respectively.
1) trigonal bipyramidal and octahedral.
2) square pyramidal and trigonal bipyramidal
3) trigonal bipyramidal and square pyramidal
4) square pyramidal and octahedral.
5) octahedral and square pyramidal

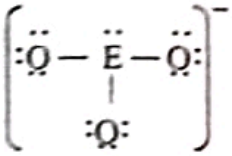
46) (2012 N)

The two N – O bond lengths in NO_2Cl are equal.	Two acceptable stable resonance structures can be drawn for NO_2Cl.

(2012)

47) The electron pair geometry and the molecular shape of XeO_2F_2 respectively are,
1) trigonal bipyramid and see – saw
2) trigonal bipyramid and tetrahedral
3) tetrahedral and see – saw
4) see – saw and trogonal bipyramid
5) square planar and tetrahedral
(2013)

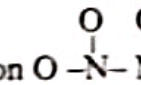
48) What is the total number of resonance structures that can be drawn for the HN_3 molecule ? (Skeleton of the molecule H – N – N – N)
1) 2 2) 3 3) 4 4) 5 5) 6 (2013)

49) 

In the structure given above, E is an element belonging to the p – block of the Periodic Table. To which group does element E belong?
1) Group 13/III A
2) Group 14/IV A
3) Group 15 / V A
4) Group 16/VI A
5) Group 17/VII A
(2014)

50) The shape and electron pair geometry of F_4ClO^- ion are respectively.
1) trigonal bipyramidal and square pyramidal.
2) square pyramidal and octahedral.
3) trigonal bipyramidal and octahedral.
4) square pyramidal and trigonal bipyramidal.
5) octahedral and square pyramidal.
(2014)

51) How many resonance structures can be drawn for the molecule N_2O_4

(skeleton )

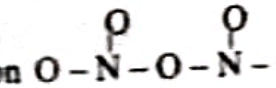
1) 2 2) 3 3) 4 4) 5 5) 6 (2014)

52) Which row of the following table gives the correct information with regard to the central S atom of the SSF_2 molecule?

	Oxidation state	Charge	Hybridization	Shape	Nature of S-S σ bond in S-SF_2
(1)	+1	0	sp^3	Tetrahedral	S (3p a.o.) + S (sp^3 h.o.)
(2)	+2	0	sp^2	Trigonal planar	S (3p a.o.) + S (sp^2 h.o.)
(3)	+2	0	sp^3	Pyramidal	S (3p a.o.) + S (sp^3 h.o.)
(4)	+1	+1	sp^3	Pyramidal	S (3p a.o.) + S (sp^3 h.o.)
(5)	+2	+1	sp^2	Trigonal planar	S (3p a.o.) + S (sp^2 h.o.)

(a.o. = atomic orbital, h.o. = hybrid orbital) (2015)

53) How many resonance structures can be drawn for the molecule N_2O_5

(skeleton ) ?

(1) 5 (2) 6 (3) 8 (4) 9 (5) none of the answers given (2015)

54) The oxidation states of $N^{①}$ and $N^{②}$ in the most stable Lewis structure of the F_2NNO molecule respectively are (skeleton, $F-\overset{F}{\underset{|}{N^{①}}}-N^{②}-O$)

1) +2 and +2 2) +1 and +3 3) +2 and +3 4) +1 and +2 5) +3 and +1 (2016)

55) How many resonance structures can be drawn for the molecule N_2O_3?

(skeleton $O-\overset{O}{\underset{|}{N}}-N-O$)

1) 2 2) 3 3) 4 4) 5 5) 6 (2016)

2.3 Secondary interactions.

1)

the boiling point of NH_3 is more than that of PH_3.	Since NH_3 has one pair of electrons. (1980)

2)

The boiling point of ortho nitro phenol is more than para nitrophenol.	ortho nitro phenol makes intra molecular H bonding. (1983)

3) Which compound has the strongest inter molecular attractive forces?

1) H_2O 2) NH_3 3) HCl 4) ClF 5) CO_2 (1987)

4) The correct statement/s regarding hydrogen bond is/are,

(a) H – bonds can be formed even without – OH groups.
(b) According to our knowledge, life can not exist without hydrogen bonds.
(c) The strength of hydrogen bond can be as high as C – H bond energy.
(d) A special type of hydrogen bond is exist in hydrogen molecule. (1987)

5) Which one of the following exhibits the strongest inter-molecular attractions?

1) NH_3 2) HI 3) H_2S 4) CH_4 5) PH_3 (1990)

6) Which one of following exhibits the weakest inter-molecular attractions?

1) NH_3 2) HI 3) CH_3Cl 4) CH_4 5) H_2S (1991)

7) Which of the following statements/ statement concerning hydrogen bonds are/ is true?

(a) Hydrogen bonds may be formed by - NH_2
(b) Hydrogen bonds may be formed by - SiH_2
(c) - CH_3 groups form strong hydrogen bonds
(d) Strong hydrogen bonds exist is liquid HF (1993)

8) Which one of the following molecules will not be polar ?

1) NH_3 2) HCl 3) CO_2 4) SO_2 5) H_2S (1994)

9) Strong hydrogen bonds,

(a) exist in CH_3OH liquid
(b) exist in CH_3COOH liquid
(c) exist in liquid NH_3
(d) exist in liquid HF (1997)

10) In which one of the following molecules is the dipolar nature least ?

1) H_2S 2) PH_3 3) AsH_3 4) H_2Se 5) BF_3 (1998)

11) Which of the following statements/ statement concerning hydrogen bonds are/ is true?
(a) Hydrogen bonds occur in $CH_3CH_2NH_2$
(b) Hydrogen bonds occur in $CH_3SiH_2OCH_3$
(c) Hydrogen bonds occur in $CH_3CH_2OSiCH_3$
(d) Hydrogen bonds occur in liquid NH_3 (1998)

12) Which one of the following molecules in non – polar (i.e. possesses zero – dipole moment) ?
1) $BeCl_2$ 2) NH_3 3) CO 4) H_2O 5) $CHCl_3$ (2001)

13)	Both sucrose ($C_{12}H_{22}O_{11}$) and KI readily dissolve in H_2O	H_2O form strong hydrogen bonds with both sucrose ($C_{12}H_{22}O_{11}$) and KI (2001
14)	Glucose is soluble in water while cholesterol is insoluble in water	Cholesterol cannot form hydrogen bonds with water (2002)

15) Which of the following arrangements gives the correct increasing order of boiling points of the compounds ?
1) $C_2H_5OH < C_2H_6 < C_2H_5F < H_2O$ 2) $C_2H_6 < C_2H_5F < H_2O < C_2H_5OH$
3) $C_2H_5F < C_2H_6 < C_2H_5OH < H_2O$ 4) $C_2H_6 < C_2H_5F < C_2H_5OH < H_2O$
5) $C_2H_6 < C_2H_5OH < C_2H_5F < H_2O$ (2004)

16) Which one of the following compound has the largest dipole moment?
1) cis ClCH = CHCl 2) CO_2 3) $Cl_2C = CCl_2$
4) CCl_4 5) trans ClCH = CHCl (2005)

17) Which of the following molecules has the lowest dipole moment?
1) NO_2 2) O_3 3) CO_2 4) SO_2 5) ClO_2 (2007)

18) Consider the following
a) liquid methane b) a mixture of water and methanol
c) an aqueous solution of LiCl d) a solution of I_2 in methanol
The correct sequence that gives the increasing strength of intermolecular forces in the above is,
1) a < d < b < c 2) a < d < c < b 3) a < b < d < c
4) a < c < b < d 5) a < b < c < d (2007)

19)	The solubility of a non-polar substance in a polar solvent is zero.	Intermolecular forces between a non-polar molecule and a polar molecule are weaker compared to dipole-dipole interactions. (2007)

20)	I_2, is more soluble aqueous KI than in pure water	KI reduces the polarity of water making non – polar I_2 more soluble (2008)

21) Which molecule or ion from those given below has the highest dipole moment ?
1) O_3 2) NH_3 3) NO_2^+ 4) $AlCl_3$ 5) ICl_4^- (2010)

22) Choose the molecule that does not have a dipole moment.
1) SF_2 2) PCl_4F 3) SF_4 4) PCl_3 5) SF_6 (2012 N)

2.4 Solid state of matter and the relationship of the properties and structure.

1)	The enthalpy of vaporization of graphite is very high.	The bonds in graphite is covalent. (1988)
2)	The melting point of diamond is very high	The bonds in diamond are covalent. (1991)
3)	The boiling point of graphite is very high	Graphite contains covalent bonds (1995)
4)	The hardness of diamond is very much higher than the hardness of solid carbon dioxide.	The C – C bond strength is very much higher than the C = O bond strength. (1997)
5)	Silica (SiO_2) has a very high melting points.	Si–O bonds are strong covalent bonds (2008)

6) Which of the following statements is/ are not true regarding graphite ?

a) All the carbon atoms in graphite are sp^3 hybridized.
b) It has a high melting point.
c) It is a conductor of electricity.
d) It is used as a fuel in industry. (2009)

7) The increasing order of boiling points of CO_2, SO_2, N_2, He and Ne is,

1) $He < Ne < N_2 < CO_2 < SO_2$
2) $He < Ne < CO_2 < N_2 < SO_2$
3) $He < Ne < N_2 < SO_2 < CO_2$
4) $Ne < He < N_2 < CO_2 < SO_2$
5) $Ne < He < CO_2 < SO_2 < N_2$

(2010)

8)	Diamond is an allotrope of carbon which does not conduct electricity	Diamond has a giant structure where each carbon atom, is covalently bonded as four other carbon atoms (2010)

9)	The boiling point of CO_2 is higher than the boiling point of formaldehyde.	Intermolecular attractive forces between CO_2 molecules are stronger than intermolecular attractive forces between formaldehyde molecules. (2011)

10) Of the following, which one has the highest boiling point?

1) H_2 2) He 3) Ne 4) Xe 5) CH_4

(2014)

Answers

2. Structure and Bonds

2.1 Primary interaction.

1)	3	2)	2	3)	3	4)	4	5)	3	6)	1
7)	4	8)	4	9)	all	10)	5	11)	5	12)	4
13)	3	14)	3	15)	2	16)	5	17)	3	18)	2
19)	5	20)	2	21)	5	22)	3	23)	4	24)	2

2.2 Geometrical arrangements of molecules and ions.

1)	5	2)	4	3)	3	4)	5	5)	3	6)	3
7)	4	8)	4	9)	2	10)	2	11)	4	12)	4
13)	5	14)	4	15)	3	16)	4	17)	all	18)	2
19)	3	20)	4	21)	1	22)	3	23)	3	24)	2
25)	2	26)	4	27)	2	28)	4	29)	5	30)	3
31)	3	32)	2	33)	3	34)	5	35)	5	36)	1
37)	3	38)	5	39)	5	40)	3	41)	2	42)	5
43)	3	44)	5	45)	4	46)	1	47)	1	48)	2
49)	5	50)	2	51)	3	52)	3	53)	4	54)	1
55)	3										

2.3 Secondary interactions.

1)	2	2)	4	3)	1	4)	1	5)	1	6)	4
7)	4	8)	3	9)	5	10)	5	11)	4	12)	1
13)	3	14)	3	15)	4	16)	1	17)	3	18)	1
19)	4	20)	3	21)	2	22)	5				

2.4 Solid state of matter and the relationship of the properties and structure.

1)	2	2)	2	3)	2	4)	3	5)	2	6)	4
7)	1	8)	1	9)	5	10)	4				