Exercise-1

ONLY ONE OPTION CORRECT TYPE

Section (A) : Physical and chemical properties of Group 13th elements

1. Which one is a non-metal in group 13(III A) ?
(1) B (2) Al (3) Ga (4) In

2. Amongst the following, which metal exist in liquid state during summer ?
(1) In (2) Ga (3) Ge (4) Tl

3. Which member of group 13 does not generally exhibit the group valency in its compounds ?
(1) Boron (2) Aluminium (3) Gallium (4) Thallium

4. Thallium shows stable +1 oxidation state because :
(1) it has higher nuclear charge (2) it shows inert pair effect
(3) it has amphoteric character (4) it has higher reactivity

5 Boric acid is polymeric due to :
(1) its acidic nature (2) the presence of hydrogen bonds
(3) its monobasic nature (4) its geometry

6. $AlCl_3$ is :
(1) anhydrous and covalent (2) anhydrous and ionic
(3) covalent and basic (4) ionic and basic

7. Which of the following oxides is amphoteric in nature ?
(1) B_2O_3 (2) SiO_2 (3) Al_2O_3 (4) CaO

8. Which of the following statement is correct ?
(1) BCl_3 and $AlCl_3$ are both Lewis acids and BCl_3 is stronger than $AlCl_3$.
(2) BCl_3 and $AlCl_3$ are both Lewis acids and $AlCl_3$ is stronger than BCl_3.
(3) BCl_3 and $AlCl_3$ are both equally strong Lewis acids.
(4) Both BCl_3 and $AlCl_3$ are not Lewis acids.

9. Which of the following statements is false ?
(1) Boron trioxide shows the basic character.
(2) Aluminium is a good reducing agent.
(3) Boron resembles in many properties with silicon.
(4) Boron does not form B^{3+} ions.

10. Which of the following statements is false about chloride of aluminium ?
(1) It on hydrolysis in water forms tetrahedral $[Al(OH)_4]^-$ species.
(2) It in acidified aqueous solution form octahedral $[Al(H_2O)_6]^{3+}$ ion.
(3) It achieves stability by forming a dimer in vapour phase.
(4) Coordination number of aluminium in its crystalline form is eight.

11. Which of the following is not correctly matched ?
(1) Oxides of boron (B_2O_3) and silicon (SiO_2) – Acidic in nature.
(2) Oxides of aluminium (Al_2O_3) and gallium (Ga_2O_3) – Amphoteric in nature.
(3) Oxides of indium (In_2O_3) and thallium (Tl_2O_3) – Basic in nature.
(4) Oxides of germanium (GeO_2) and tin (SnO_2) – Acidic in nature.

Section (B) : Compounds of boron and aluminium

1. On the addition of mineral acid to an aqueous solution of borax, which of the following compound is formed?
(1) Boron hydride (2) Orthoboric acid (3) Metaboric acid (4) Pyroboric acid

2. Borax is :
(1) $Na_2B_4O_7$ (2) $Na_2B_4O_7.4H_2O$ (3) $Na_2B_4O_7.7H_2O$ (4) $Na_2B_4O_7.10H_2O$

3. Which of the following metal ions gives borax bead test ?
(1) Zn^{+2} (2) Pb^{+2} (3) Al^{+3} (4) Mn^{+2}

4. When borax is heated in a Bunsen burner flame with CoO on a loop of platinum wire :
(1) a coloured $CoBO_2$ bead is formed. (2) a coloured $Co(BO_2)_3$ bead is formed.
(3) a coloured CoBO bead is formed. (4) a coloured $Co(BO_2)_2$ bead is formed.

5. Borax is used :
(1) in making enamel and pottery glazes (2) as a flux in soldering
(3) in making optical glasses. (4) All of these

6. From the B_2H_6 all the following can be prepared except :
(1) H_3BO_3 (2) $[BH_2(NH_3)_2]^+ [BH_4]^-$ (3) $B_2(CH_3)_6$ (4) $NaBH_4$

7. Diborane reacts with water to form :
(1) HBO_2 (2) H_3BO_3 (3) $H_3BO_3 + H_2$ (4) H_2

8. When Al is added to sodium hydroxide solution:
(1) no reaction takes place (2) oxygen is evolved
(3) water is produced (4) hydrogen is evolved

9. Alum is not used :
(1) As a mordant in dyeing (2) As an insecticide
(3) In the purification of water (4) In tanning of leather

10. In the following reaction : $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$:
(1) $B(OH)_3$ is a Lewis acid. (2) $B(OH)_3$ is a Lewis base.
(3) $B(OH)_3$ is amphoteric. (4) none is correct.

11. Correct formula of borax is :
(1) $Na_2[B_4O_5(OH)_4].8H_2O$ (2) $Na[B_4O_5(OH)_5].8H_2O$
(3) $Na_2[B_4O_5(OH)_4].10H_2O$ (4) $Na_2[B_4O_5(OH)_4].6H_2O$

12. When borax is dissolved in water :
(1) $B(OH)_3$ is formed only (2) $[B(OH)_4]^-$ is formed only
(3) both $B(OH)_3$ and $[B(OH)_4]^-$ are formed (4) $[B_3O_3(OH)_4]^-$ is formed only

13. Borax bead test is responded by :
(1) divalent metals (2) heavy metals
(3) light metals (4) metal which forms coloured metaborates

14. Which of the following products are obtained when BCl_3 reacts with water ?
(1) $B(OH)_3 + HCl$ (2) $B_2H_6 + HCl$ (3) $B_2O_3 + HCl$ (4) $B_2H_5Cl + H_2$

15. Identify the incorrect statement about the structure of diborane.
(1) The four terminal hydrogen atoms and the two boron atoms lie in one plane.
(2) There are two bridging hydrogen atoms.
(3) All six B – H bond are regular two centre two electron bonds.
(4) The hybridisations of both the boron atoms are same and sp^3.

16. Alum is found to contain hydrated monovalent cation $[M(H_2O)_6]^+$, trivalent cation $[M'(H_2O)_6]^{3+}$ and SO_4^{2-} in the ratio of :
(1) 1 : 1 : 1 (2) 1 : 2 : 3 (3) 1 : 3 : 2 (4) 1 : 1 : 2

17. Alumina is :
(1) acidic (2) basic (3) amphoteric (4) none of these

18. Aluminium oxide is not reduced by chemical reactions since :
(1) aluminium oxide is reactive (2) reducing agents contaminate
(3) aluminium oxide is highly stable (4) the process pollutes the environment

Section (C) : Physical and Chemical properties of Group 14th elements

1. Which of the following is a semiconductor ?
(1) C (2) Si (3) Pb (4) Sn

2. The stability of tetrahalides of Si, Ge, Sn and Pb increases in the order :
(1) $Pb^{4+} < Sn^{4+} < Ge^{4+} < Si^{4+}$ (2) $Si^{4+} < Ge^{4+} < Sn^{4+} < Pb^{4+}$
(3) $Pb^{4+} < Ge^{4+} < Si^{4+} < Sn^{4+}$ (4) $Sn^{4+} < Ge^{4+} < Pb^{4+} < Si^{4+}$

3. The bond dissociation energy of M–M bond decreases in the order :
(1) Sn–Sn > Ge–Ge > Si–Si > C–C (2) C–C > Si–Si > Ge–Ge > Sn–Sn
(3) C–C > Ge–Ge > Si–Si > Sn–Sn (4) C–C > Si–Si > Sn–Sn > Ge–Ge

4. C and Si have :
(1) Same physical properties.
(2) Different physical properties.
(3) Same physical but different chemical properties.
(4) Different chemical and physical properties.

5. Elements of group 14 :
(1) exhibit oxidation state of +4 only (2) exhibit oxidation state of +2 and +4
(3) form M^{-2} and M^{4+} ions (4) form M^{2+} and M^{4+} ions

6. The ability of a substance to assume two or more crystalline structures is called :
(1) isomerism (2) polymorphism (3) isomorphism (4) amorphism

7. Carbon forms a large number of compounds because it has:
(1) fixed valency (2) contains non-metallic nature
(3) high ionization potential (4) contains property of catenation

8. Silicon is an important constituent of :
(1) chlorophyll (2) haemoglobin (3) rocks (4) amalgams

9. Diamond and graphite are :
(1) isomers (2) isotopes (3) allotropes (4) none of the above

10. Which one of the following is effected by the water ?
(1) Pb (2) C (3) Ge (4) None

11. Which one of these is acidic ?
(1) Al_2O_3 (2) SnO_2 (3) PbO_2 (4) SiO_2

12. Which of the following statements is correct with respect to the property of elements with increase in atomic number in the carbon family (group 14) ?
(1) Their metallic character decrease. (2) The stability of +2 oxidation state increase.
(3) Their ionization energies increase. (4) Their atomic size decrease.

13. Ge(II) compounds are powerful reducing agents whereas Pb(IV) compounds are strong oxidants. It can be due to :
(1) Pb is more electropositive than Ge.
(2) ionization potential of lead is less than that of Ge.
(3) ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+}.
(4) more pronounced inert pair effect in lead than in Ge.

14. C_{60} molecule has a shape like :
(1) soccer ball (2) bucky ball (3) hockey ball (4) tennis ball

15. $[SiCl_6]^{2-}$ is not known because :
(1) six large chloride ions can not be accomodated around smaller Si^{4+} due to limitation of its size.
(2) there is large difference in the electronegativity values between Si and Cl.
(3) six small chloride ions cannot be accomodated around smaller Si^{4+} due to limitation of its size.
(4) the sum of first four ionisation energies is quite high.

16. In graphite, electrons are :
(1) localised on every third C-atom. (2) present in anti-bonding orbital.
(3) localised on each C-atom. (4) spread out between the structure.

17. Which of the following is true for diamond ?
(1) It is a good conductor of electricity. (2) It is soft.
(3) It is a good conductor of heat. (4) It is made up of C, H and O.

Section (D) : Compounds of carbon and silicon

1. Carbon monoxide is :
(1) acidic (2) neutral (3) amphoteric (4) basic

2. A gas which burns with a blue flame is :
(1) CO (2) O_2 (3) N_2 (4) CO_2

3. When a mixture of air and steam is passed over red hot coke, the outgoing gas is :
(1) producer gas (2) water gas (3) coal gas (4) none of these gases

4. Water gas is the mixture of :
(1) CO and N_2 (2) CO and H_2 (3) N_2 and NH_3 (4) CO, H_2 and N_2

5. Glass is soluble in :
(1) HF (2) H_2SO_4 (3) $HClO_4$ (4) aqua-regia

6. Silicon reacts with hot solution of NaOH forming :
(1) $Si(OH)_4$ (2) $Si(OH)_2$ (3) SiO_2 (4) Na_2SiO_3

7. The structural unit present in pyrosillicates is :
(1) $Si_3O_9^{6-}$ (2) SiO_4^{4-} (3) $Si_2O_7^{6-}$ (4) $(Si_2O_5^{2-})_n$

8. Quartz is a crystalline variety of :
(1) Si (2) SiO_2 (3) Na_2SiO_3 (4) SiC

9. Which oxide of carbon is obtained when potassium hexacyanidoferrate(II) is warmed with concentrated sulphuric acid ?
(1) CO (2) CO_2 (3) Both (4) None

10. When a mixture of carbon monoxide and chlorine is exposed to sunlight the product formed is :
(1) thionyl chloride (2) phosgene (3) phosphine (4) carbon tetrachloride

11. CO_2 in water behaves as :
(1) weak dibasic acid H_2CO_3 (2) weak monobasic acid HO – CO_2H
(3) weak diacid base $CO(OH)_2$ (4) weak monoacid base HO – CO_2H

12. How many O-atoms are shared per SiO_4 tetrahedral in sheet silicates ?
(1) 4 (2) 2 (3) 3 (4) 1

13. Which of the following anions is present in the ring/cyclic structure of silicates ?
(1) SiO_4^{4-} (2) $Si_2O_7^{6-}$ (3) $Si_3O_9^{6-}$ (4) $(Si_2O_5^{2-})_n$

14. Man-made silicate is :
(1) cement (2) feldspar (3) mica (4) zeolites

Exercise-2

1. Which one of the following pairs of elements has nearly same (i.e. difference of only 2-3 kJ mol^{-1}) first ionisation energies ?
(1) Al, Ga (2) B, Ga (3) In, Tl (4) B, Tl

2. In IIIA group, Tl (thallium) shows +1 oxidation state while other members show +3 oxidation state. Why ?
(1) Presence of lone pair of electron in Tl (2) Inert pair effect
(3) Large ionic radius of Tl ion (4) None of these

3. The relative stability of +1 oxidation state progressively increases for heavier elements :
Al < Ga < In < Tl. It is due to :
(1) decreasing first ionisation enthalpy down the group with increasing atomic number.
(2) increasing electronegativity down the group with increasing atomic number.
(3) poor shielding effect of interveining d and f orbitals down the group with increasing atomic number resulting into increased effective nuclear charge.
(4) increasing atomic size down the group with increasing atomic number.

4. The ion(s) that act/s as an oxidising agent in solution is/are :
(1) Tl^+ and Al^{3+} (2) B^{3+} and Al^{3+} (3) Tl^{3+} only (4) B^{3+} only

5. Aluminium is not used :
(1) in silvery paints (2) for making utensils
(3) as a reducing agent (4) as oxidizer in metallurgy

6. Aluminium vessels should not be washed with materials containing washing soda because :
(1) washing soda is expensive.
(2) washing soda is easily decomposed.
(3) washing soda reacts with aluminium to form soluble aluminate.
(4) washing soda reacts with aluminium to form insoluble aluminium oxide.

7. Aluminium is more reactive than iron. But aluminium is less easily corroded than iron because:
(1) aluminium is a noble metal.
(2) oxygen forms a protective oxide layer on aluminium surface.
(3) iron undergoes reaction with water more easily .
(4) iron forms both trivalent and divalent ions.

8. Which one of the following can not be prepared in + 3 oxidation state by the reaction of metals with I_2 ?
(1) AlI_3 (2) TlI_3 (3) BI_3 (4) GaI_3

9. Borax is used as a buffer since :
(1) its aqueous solution contains equal amount of weak acid and its salt.
(2) it is easily available.
(3) its aqueous solution contains equal amount of strong acid and its salt.
(4) statement that borax is a buffer, is wrong.

10. Which of the following is a monobasic Lewis acid ?
(1) $B(OH)_3$ (2) $PO(OH)_3$ (3) $SO_2(OH)_2$ (4) $ClO_3(OH)$

11. Which one of the following is the correct statement ?
(1) Boric acid is a protonic acid.
(2) Both Tl^{3+} and Al^{3+} ions act as oxidsing agent in aqueous solution.
(3) Hydrogen bonding in H_3BO_3 gives it a layered structure.
(4) $B(OEt)_3$ imparts blue colour to the burner flame.

12. H_3BO_3 ionises in water as :
(1) $H_3BO_3(aq) \rightleftharpoons H^+(aq) + H_2BO_3^-(aq)$
(2) $H_3BO_3(aq) \rightleftharpoons 2H^+(aq) + HBO_3^-(aq)$
(3) $H_3BO_3(aq) \rightleftharpoons 3H^+(aq) + BO_3^{3-}(aq)$
(4) None of these

13. Identify the statement that is not correct as far as structure of diborane is concerned.
(1) There are two bridging hydrogen atoms and four terminal hydrogen atoms in diborane.
(2) Each boron atom forms four bonds in diborane.
(3) The hydrogen atoms are not in the same plane in diborane.
(4) All B-H bonds in diborane are similar.

14. Which of the following is an amphoteric oxide ?
(1) MgO (2) Al_2O_3 (3) Cl_2O_7 (4) Ti_2O_2

15. The amphoteric oxides are :
(1) boron trioxide and aluminium oxide. (2) aluminium oxide and gallium oxide.
(3) indium oxide and thallium oxide. (4) none of these.

16. Which of the following does not exist in free state ?
(1) BF_3 (2) BCl_3 (3) BBr_3 (4) BH_3

17. Acidic strength of Boron trihalide is in order :
(1) $BF_3 < BCl_3 < BBr_3 < BI_3$ (2) $BI_3 < BBr_3 < BCl_3 < BF_3$
(3) $BBr_3 < BCl_3 < BF_3 < BI_3$ (4) $BF_3 < BI_3 < BCl_3 < BBr_3$

18. What is true about the structure of dimer of $AlCl_3$?
(1) It has two types of Al–Cl bond lengths.
(2) Bridging bond angle, Cl–Al–Cl is smaller than terminal bond angle, Cl–Al–Cl
(3) In each aluminium, one empty p-orbital participate in sp^3 hybridisation.
(4) All of these.

19. Which of the following statements about diborane is not true ?
(1) The B atoms in it are sp^3-hybridized.
(2) It contains two 3-centre-2-electron bonds.
(3) All B–H bond lengths are equal due to resonance.
(4) The molecule is non-planar.
(5) The molecule contains 12 valence electrons.

20. When orthoboric acid (H_3BO_3) is heated, the residue left is :
(1) metaboric acid (2) boron (3) boric anhydride (4) borax

21. An aqueous solution of borax is :
(1) neutral (2) amphoteric (3) basic (4) acidic

22. The product obtained in the reaction of diborane with excess of ammonia at low temperature is :
(1) $B_2H_6.NH_3$ (2) $B_2H_6.2NH_3$ (3) $(BN)_x$ (4) Borazine

23. Which of the following is known as inorganic benzene ?
(1) Borazine (2) Boron nitride (3) p-dichlorobenzene (4) Phosphonitrilic acid

24. The dissolution of $Al(OH)_3$ in a solution of NaOH results in the formation of :
(1) $[Al(H_2O)_4(OH)]^{2+}$ (2) $[Al(H_2O)_2(OH)_4]^-$ (3) $[Al(H_2O)_3(OH)_3]$ (4) $[Al(H_2O)_6(OH)_3]$

25. **S_1 :** Chlorides of both Be and Al have chloride bridged structure in solid phase.
S_2 : $B(OH)_3$ is acidic in nature.
S_3 : Borax forms orthoboric acid when warmed with concentrated sulphuric acid.
(1) T F T (2) T T F (3) F T T (4) F T F

26. Coal gas is a mixture of :
(1) CO and H_2.
(2) H_2, saturated and unsaturated hydrocarbons, CO, CO_2, N_2 and O_2.
(3) saturated and unsaturated hydrocarbons.
(4) CO, CO_2 and CH_4.

27. Carbon has allotropic forms due to :
(1) its property of catenation (2) its ability to form $p\pi$-$p\pi$ bond
(3) its non-metallic character (4) (1) and (2) both

28. Which of the following statements is incorrect ?
(1) Sn^{2+} compounds act as reducing agent.
(2) Pb^{4+} compounds act as oxidising agent.
(3) Oxides of Sn and Pb are amphoteric in nature.
(4) Both tin and silicon decompose steam to produce SnO_2 / SiO_2 and H_2.

29. Unlike $PbCl_4$, PbI_4 and $PbBr_4$ are not found because :
(1) chlorine is more electropositive.
(2) iodine and bromine are of large size.
(3) iodine and bromine are unable to oxidise Pb to Pb^{4+}.
(4) The statement is wrong.

30. Which of the following allotropic forms of carbon is isomorphous with crystalline silicon ?
(1) Graphite (2) Coal (3) Coke (4) Diamond

31. $C(s) + H_2O(g) + Air \xrightarrow{1273K}$ products.
The products are :
(1) CO, H_2, N_2 (2) CO_2, H_2, N_2 (3) CO, CO_2, N_2 (4) CO, CH_4, N_2

32. CO forms a voltile compound with :
(1) nickel (2) copper (3) sodium (4) aluminium

33. In which of the following silicates, three O-atoms are shared per SiO_4 tetrahedral ?
(1) Orthosilicate (2) Pyrosilicate (3) Cyclic silicate (4) Sheet silicate

34. $Me_2SiCl_2 \xrightarrow{H_2O}$ (A) $\xrightarrow{\text{condensation}}$ (B).
The nature of product (B) may be :
(1) only linear polymers (2) cyclic products
(3) (1) and (2) both (4) none of these

35. A complex cross-linked polymer (silicone) is formed by :
(1) hydrolysis of $(CH_3)_3$ SiCl.
(2) hydrolysis of a mixture of $(CH_3)_3SiCl$ and $(CH_3)_2SiCl_2$
(3) hydrolysis of CH_3SiCl_3
(4) hydrolysis of $SiCl_4$.

36. Nitrogen gas is absorbed by :
(1) calcium hydroxide (2) ferrous sulphate (3) calcium carbide (4) aluminium carbide

37. Which of the following statements is false for silicon dioxide ?
(1) In SiO_2, each silicon atom is covalently bonded in a tetrahedral manner to four oxygen atoms.
(2) In SiO_2, each oxygen atom is covalently bonded to two silicon atoms.
(3) In SiO_2, each oxygen atom is tetrahedrally bonded to four silicon atoms.
(4) SiO_2 structure has eight membered rings with alternate silicon and oxygen atoms.

38. SiF_4 gets hydrolysed giving .....
(1) SiO_2 (2) $Si(OH)_2F_2$ (3) H_2SiF_6 (4) $Si(OH)_4$

39. Hydrolysis of $SiCl_4$ yields :
(1) H_2SiO_3 (2) H_2SiO_4 (3) H_2SiCl_6 (4) None of these

40. Carborundum is :
(1) SiC (2) $AlCl_3$ (3) $Al_2(SO_4)_3$ (4) $Al_2O_3.2H_2O$

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. The correct order of C–O bond length among CO, CO_3^{2-} and CO_2 is : **[AIPMT 2007]**
(1) $CO_2 < CO_3^{2-} < CO$ (2) $CO < CO_3^{2-} < CO_2$ (3) $CO_3^{2-} < CO_2 < CO$ (4) $CO < CO_2 < CO_3^{2-}$

2. Which one of the following compounds is a peroxide ? **[AIPMT 2010]**
(1) KO_2 (2) BaO_2 (3) MnO_2 (4) NO_2

3. The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence : **[AIPMT 2010]**
(1) $BCl_3 > BF_3 > BBr_3$ (2) $BBr_3 > BCl_3 > BF_3$ (3) $BBr_3 > BF_3 > BCl_3$ (4) $BF_3 > BCl_3 > BBr_3$

4. Which one of the following pairs is isostructural (i.e. having the same shape and hybridization) ? **[AIPMT 2012]**
(1) [BCl_3 and $BrCl_3$] (2) [NH_3 and NO^-_3] (3) [NF_3 and BF_3] (4) [BF_4^- and NH^+_4]

5. Which of the following is electron-deficient ? **[NEET 2013]**
(1) $(SiH_3)_2$ (2) $(BH_3)_2$ (3) PH_3 (4) $(CH_3)_2$

6. Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but not by the other ? **[AIPMT-2015]**
(1) is a reducing agent (2) is soluble in water
(3) is used as a food-preservative (4) form 'acid-rain'

7. Boric acid is an acid because its molecule **[NEET-2016]**
(1) Combines with proton from water molecule (2) Contains replaceable H^+ ion
(3) Gives up a proton (4) Accepts OH^- from water releasing proton

8. AlF_3 is soluble in HF only in presence of KF. It is due to the formation of **[NEET-2016]**
(1) $K[AlF_3H]$ (2) $K_3[AlF_3H_3]$ (3) $K_3[AlF_6]$ (4) AlH_3

9. It is because of inability of ns^2 electrons of the valence shell to participate in bonding that : **[NEET-2017]**
(1) Sn^{2+} is reducing while Pb^{4+} is oxidising
(2) Sn^{2+} is oxidising while Pb^{4+} is reducing
(3) Sn^{2+} and Pb^{2+} are both oxidising and reducing
(4) Sn^{4+} is reducing while Pb^{4+} is oxidising

10. The correct order of atomic radii in group 13 elements is **[NEET-2018]**
(1) B < Al < In < Ga < Tl (2) B < Ga < Al < In < Tl
(3) B < Ga < Al < Tl < In (4) B < Al < Ga < In < Tl

11. Which one of the following elements is unable to form MF_6^{3-} ion ? **[NEET-2018]**
(1) Ga (2) In (3) B (4) Al

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. In diborane, the two H — B — H angles are nearly : **[AIIMS 2005]**
(1) 60°, 120° (2) 95°, 120° (3) 95°, 150° (4) 120°, 180°

2. The wrong statement about fullerene is : **[AIIMS 2011]**
(1) it has 5-membered carbon ring
(2) it has 6-membered carbon ring
(3) it has sp^2 hybridization
(4) it has 5-membered rings more than 6-membered rings.

3. **Assertion :** $R_3P = O$ exists $R_3N = O$ does not exist. **[AIIMS 2011]**
Reason : P is more electronegative than N.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

4. **Assertion** : Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds.
Reason : The higher oxidation sate for group-14 elements are more stable for the heavier member of the group due to inert pair effect. **[AIIMS 2017]**
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

5. In Alum : $K_2SO_4 \cdot Al_2(SO_4)_3 . 24H_2O$ **[AIIMS 2018]**
Which metal can replace Al
(1) Cr (2) Mn (3) In (4) Sc

PART - III : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. Aluminium is extracted by the electrolysis of : **[AIEEE 2002]**
(1) alumina (2) bauxite
(3) molten cryolite. (4) alumina mixed with molten cryolite & CaF_2

2. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behaviour is that graphite : **[AIEEE 2003]**
(1) is a non-crystalline substance.
(2) is an allotropic form of diamond.
(3) has molecules of variable molecular masses like polymers.
(4) has carbon atoms arranged in large plates of rings of strongly bound carbon atoms with weak interplate bonds.

3. The soldiers of Napolean army while at Alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White metallic tin buttons got converted to grey powder. This transformation is related to : **[AIEEE 2004]**
(1) a change in the crystalline structure of tin.
(2) an interaction with nitrogen of the air at very low temperature.
(3) a change in the partial pressure of oxygen in the air.
(4) an interaction with water vapour contained in the humid air.

4. Aluminium chloride exists as dimer, Al_2Cl_6 in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives : **[AIEEE 2004]**
(1) $[Al(OH)_6]^{3-} + 3HCl$ (2) $[Al(H_2O)_6]^{3+} + 3Cl^-$ (3) $Al^{3+} + 3Cl^-$ (4) $Al_2O_3 + 6HCl$

5. In silicon dioxide : **[AIEEE 2005]**
(1) there are double bonds between silicon and oxygen atoms.
(2) silicon atom is bonded to two oxygen atoms.
(3) each silicon atom is surrounded by two oxygen atoms and each oxygen atom is bonded to two silicon atoms.
(4) each silicon atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms.

6. Heating an aqueous solution of aluminium chloride to dryness will give : **[AIEEE 2005]**
(1) $Al(OH)Cl_2$ (2) Al_2O_3 (3) Al_2Cl_6 (4) $AlCl_3$

7. The structure of diborane (B_2H_6) contains : **[AIEEE-2005]**
(1) four 2c–2e bonds and four 3c–2e bonds (2) two 2c–2e bonds and two 3c–3e bonds
(3) two 2c–2e bonds and four 3c–2e bonds (4) four 2c–2e bonds and two 3c–2e bonds

8. The number and type of bonds between two carbon atoms in calcium carbide are :
[AIEEE-2005, 2011]
(1) one sigma, one pi (2) one sigma, two pi (3) two sigma, one pi (4) two sigma, two pi

9. The bond dissociation energy of B – F in BF_3 is 646 kJ mol^{-1} whereas that of C – F in CF_4 is 515 kJ mol^{-1}. The correct reason for higher B – F bond dissociation energy as compared to that of C – F is :
[AIEEE-2009]
(1) stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4.
(2) significant $p\pi$-$p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4.
(3) lower degree of $p\pi$-$p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4.
(4) smaller size of B-atom as compared to that of C-atom.

10. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence : **[AIEEE 2007]**
(1) $GeX_2 < SiX_2 < SnX_2 < PbX_2$ (2) $SiX_2 < GeX_2 < PbX_2 < SnX_2$
(3) $SiX_2 < GeX_2 < SnX_2 < PbX_2$ (4) $PbX_2 < SnX_2 < GeX_2 < SiX_2$

11. In context with the industrial preparation of hydrogen from water gas (CO + H_2), which of the following is the correct statement ? **[AIEEE 2008]**
(1) CO is removed by absorption in aqueous Cu_2Cl_2 Solution.
(2) H_2 is removed through occlusion with Pd.
(3) CO is oxidized to CO_2 with steam in the presence of a catalyst, followed by absorption of CO_2 in alkali.
(4) CO and H_2 are fractionally separated using differences in their densities.

12. Among the following substituted silanes, the one which will give rise to cross linked silicone polymer on hydrolysis is : **[AIEEE 2008]**
(1) $RSiCl_3$ (2) R_2SiCl_2 (3) R_3SiCl_2 (4) R_4Si

13. Which one of the following is the correct statement ? **[AIEEE 2008]**
(1) Beryllium exhibits coordination number of six.
(2) Chlorides of both beryllium and aluminium have bridged structures in vapour phase.
(3) $B_2H_6.2NH_3$ is known as 'inorganic benzene'.
(4) Boric acid is a protonic acid.

14. Boron cannot form which one of the following anions? **[AIEEE 2011, 4/120]**
(1) BF_6^{3-} (2) BH_4^- (3) $B(OH)_4^-$ (4) BO_2^-

15. Correct statements amongst a to d regarding silicones are : **[JEE (Main) 2019, 4/120]**
(a) They are polymers with hydrophobic character.
(b) They are biocompatible.
(c) In general, they have high thermal stability and low dielectric strength.
(d) Usually, they are resistant to oxidation and used as greases.
(1) (a), (b) and (c) only (2) (a) and (b) Only
(3) (a), (b) and (d) only (4) (a), (b), (c) and (d)

16. The chloride that CANNOT get hydrolysed is : **[JEE (Main) 2019, 4/120]**
(1) $PbCl_4$ (2) $SiCl_4$ (3) CCl_4 (4) $SnCl_4$

17. The element that does **NOT** show catenation is: **[JEE (Main) 2019, 4/120]**
(1) Sn (2) Si (3) Ge (4) Pb

Answers

EXERCISE - 1

SECTION (A)

1.	(1)	**2.**	(2)	**3.**	(4)	**4.**	(2)	**5**	(2)	**6.**	(1)	**7.**	(3)
8.	(1)	**9.**	(1)	**10.**	(4)	**11.**	(4)						

SECTION (B)

1.	(2)	**2.**	(4)	**3.**	(4)	**4.**	(4)	**5.**	(4)	**6.**	(3)	**7.**	(3)
8.	(4)	**9.**	(2)	**10.**	(1)	**11.**	(1)	**12.**	(3)	**13.**	(4)	**14.**	(1)
15.	(3)	**16.**	(4)	**17.**	(3)	**18.**	(3)						

SECTION (C)

1.	(2)	**2.**	(1)	**3.**	(2)	**4.**	(4)	**5.**	(2)	**6.**	(2)	**7.**	(4)
8.	(3)	**9.**	(3)	**10.**	(1)	**11.**	(4)	**12.**	(2)	**13.**	(4)	**14.**	(1,2)
15.	(1)	**16.**	(4)	**17.**	(3)								

SECTION (D)

1.	(2)	**2.**	(1)	**3.**	(1)	**4.**	(2)	**5.**	(1)	**6.**	(4)	**7.**	(3)
8.	(2)	**9.**	(1)	**10.**	(2)	**11.**	(1)	**12.**	(3)	**13.**	(3)	**14.**	(1)

EXERCISE - 2

1.	(1)	**2.**	(2)	**3.**	(3)	**4.**	(3)	**5.**	(4)	**6.**	(3)	**7.**	(2)
8.	(2)	**9.**	(1)	**10.**	(1)	**11.**	(3)	**12.**	(4)	**13.**	(4)	**14.**	(2)
15.	(2)	**16.**	(4)	**17.**	(1)	**18.**	(4)	**19.**	(3)	**20.**	(3)	**21.**	(3)
22.	(2)	**23.**	(1)	**24.**	(2)	**25.**	(3)	**26.**	(2)	**27.**	(4)	**28.**	(4)
29.	(3)	**30.**	(4)	**31.**	(1)	**32.**	(1)	**33.**	(4)	**34.**	(1)	**35.**	(3)
36.	(3)	**37.**	(3)	**38.**	(4)	**39.**	(1)	**40.**	(1)				

EXERCISE - 3

PART-I

1.	(4)	**2.**	(2)	**3.**	(2)	**4.**	(4)	**5.**	(2)	**6.**	(3)	**7.**	(4)
8.	(3)	**9.**	(1)	**10.**	(2)	**11.**	(3)						

PART-II

1.	(2)	**2.**	(4)	**3.**	(3)	**4.**	(3)	**5.**	(1)				

PART-III

1.	(4)	**2.**	(4)	**3.**	(1)	**4.**	(2)	**5.**	(4)	**6.**	(2)	**7.**	(4)
8.	(2)	**9.**	(2)	**10.**	(3)	**11.**	(3)	**12.**	(1)	**13.**	(2)	**14.**	(1)
15.	(4)	**16.**	(3)	**17.**	(4)								