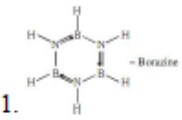
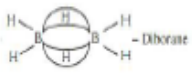
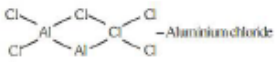
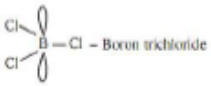
III-A & IV-A GROUP ELEMENTS

1	Statements regarding the general characteristics of IIIA group elements i) The decreasing order of E.N. of IIIA group element is B > Tl > In > Ga > Al ii) The $E^0_{M^{+3}/M}$ values decreases in the order Tl > In > Ga > Al iii) Ga has high melting point because of its polymeric structure The correct statements in above are 1) (i) and (ii) are correct 2) (ii) and (iii) are correct 3) only (ii) is correct 4) (i) & (iii) are correct
2	Regarding III A group elements the incorrect statement is 1) $MP-B>In>Al>Ga>Tl$ 2) $EN-B>Tl>In>Ga>Al$ 3) $IP_1-B>Tl>Ga>Al>In$ 4) Density - $Tl>In>Ga>Al>B$
3	Group 13 elements show +1 and +3 oxidation states. Relative stability of +3 oxidation state may be given as 1. $Ti^{3+}>In^{3+}>Ga^{3+}>Al^{3+}>B^{3+}$ 2. $B^{3+}>Al^{3+}>Ga^{3+}>In^{3+}>Ti^{3+}$ 3. $Al^{3+}>Ga^{3+}>Ti^{3+}>In^{3+}>B^{3+}$ 4. $Al^{3+}>B^{3+}>Ga^{3+}>Ti^{3+}>In^{3+}$
4	Which species does not exist 1) $[BF_6]^{3-}$ 2) $[AlF_6]^{3-}$ 3) $[GaF_6]^{3-}$ 4) $[InF_6]^{3-}$
5	Which of the following structure is similar to graphite? 1) BN 2) B 3) B_4C 4) B_2H_6
6	The number B-O-B linkage in trimetaborate and the anionic part of borax is – 1) 3, 5 2)5, 3 3) 0, 5 4) 0, 4
7	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) $NaBH_4$
8	The number of possible isomers for disubstituted borazine $(B_3N_3H_4X_2)$ is/are (1) 4 (2) 3 (3) 2 (4) 1
9	Three centred two electron bond is present in 1) B_2H_6 2) NH_3 3) BCl_3 4) $AlCl_3$
10	Moissan boron is 1) 95-98% pure amorphous boron 2) 75-78% pure amorphous boron 3) 95-98% pure crystalline boron 4) 75-78% pure crystalline boron
11	Borax glass is a mixture of 1) $NaBO_2+B_2O_3$ 2) $Na_2B_4O_7+B_2O_3$ 3) $H_2B_4O_7+B_2O_3$ 4) $Na_2B_4O_7.10H_2O+B_2O_3$
12	Inorganic benzene is 1) $B_3H_3N_3$ 2) BH_3NH_3 3) $B_3N_3H_6$ 4) $H_3B_3N_6$
13	In diborane, boron atoms undergo …. Type of hybridization. 1) sp 2) sp^2 3) sp^3 4) sp^3d

	: (3) : In B_2H_6 the hybridization of at boran $\rightarrow sp^3$
14	Total number of electrons shared between two B-H-B atoms in B_2H_6 1. 2 2.3 3. 4 4. 6
15	Which is arachno borane ? 1. B_5H_{11} 2. B_6H_{10} 3. B_2H_6 4. B_2H_5
16	Boric acid is polymeric due to 1. Its acidic nature 2. Its geometry 3. due to covant nature 4. The presence of Hydrogen bonds
17	When borax is heated in Bunsen burner flame with a metal oxide 'x' on a loop of platinum wire a blue coloured bead 'y' is formed. What are 'x' and 'y'? 1) $CoO, CO(BO_2)_2$ 2) $CuO, Cu(BO_2)_2$ 3) $Cr_2O_3, Cr(BO_2)_3$ 4) $Cu_2O, Cu(BO_2)_2$
18	The reaction $B_2H_6 + 2CO \rightarrow 2BH_3.CO$ is an example for which type of reaction? 1) Reduction 2) Dispropartination 3) Cleavage 4) Oxidation
19	In the reaction $2'x' + B_2H_6 \rightarrow [BH_2(x)_2]^+[BH_4]^-$ the amine 'x' will not be :- 1. NH_3 2. CH_3CH_2 3. $(CH_3)_2NH$ 4. $(CH_3)_3N$
20	The bonds present in borazine are 1) $12\sigma, 3\pi$ 2) $9\sigma, 6\pi$ 3) $6\sigma, 6\pi$ 4) $9\sigma, 9\pi$
21	Borax is prepared by treating colmenite with 1. $NaNO_3$ 2.NaCl 3. Na_2CO_3 4. $NaHCO_3$
22	Which is false in case of H_3BO_3 (Boric Acid)? 1. It is soluble in hot water 2. It is a tribasic acid 3. It has a planner structure 4. It acts as a mono basic acid
23	Which of the following compounds is not matched correctly with its structure? 1.  – Borazine 2.  – Diborane 3.  – Aluminium chloride 4.  – Boron trichloride
24	Diborane is instantly hydrolysed by water to give (1) $B_2O_3 + H_2O_2$ (2) $H_3BO_3 + H_2$ (3) $H_3BO_3 + O_2$ (4) $B_2O_3 + H_3BO_3$
25	The maximum number of atom may be present in one plane in B_2H_6 is : (1) 5 (2) 6 (3) 7 (4) 8
26	Which of following reaction is/are incorrect (1) $BCl_3 + H_2O \rightarrow H_3BO_3 + HCl$ (2) $B_2H_6 + H_2O \rightarrow H_3BO_3 + H_2$ (3) $BN + H_2O \rightarrow B_2O_3 + NH_3$ (4) $Na_2B_4O_7 + H_2SO_4 + H_2O \rightarrow H_3BO_3 + Na_2SO_4$
27	Borax is prepared by treating colmenite with (1) $NaNO_3$ (2) NaCl (3) Na_2CO_3 (4) $NaHCO_3$
28	Which reactions can be used to prepare diborane I. $NaBH_4 + BF_3(in\ ether) \rightarrow$ II. $NaBH_4 + I_2 \rightarrow$ III. $BF_3 + NaH \rightarrow$ (1) I,III (2) I,II (3) II,III (4) I,II and III

29 $Na_2B_4O_7.10H_2O \xrightarrow{\Delta} NaBO_2 + (A) + H_2O;\ (A) + MnO \xrightarrow{\Delta} (B), (A) and\ (B) are$

(1) $Na_3BO_3, Mn_3(BO_3)_2$ (2) $Na_2(BO_2)_2, Mn(BO_2)_2$

(3) $B_2O_3, Mn(BO_2)_2$ (4) none is correct

30 In reaction $BF_3 + 3LiBH_4 \rightarrow 3LiF + X$; here X is :

(1) B_4H_{10} (2) B_2H_6 (3) BH_3 (4) B_3H_8

31 Which of the following compounds shows least tendency towards hydrolysis :-

(1) BF_3 (2) BCl_3 (3) BBr_3 (4) BI_3

32 In the reaction ; $2x + B_2H_6 \rightarrow \left[BH_2(x)_2\right]^+ \left[BH_4\right]^-$ the amine 'x' will not be :-

(1) NH_3 (2) CH_3NH_2 (3) $(CH_3)_2NH$ (4) $(CH_3)_3N$

33 Which of the following have 3C – $2e^-$ bond:

I. Al_2Cl_6 II. B_2H_6 III. Fe_2Cl_6 IV. Si_2H_6

(1) I, II (2) II, IV (3) Only II (4) I, III, IV

34 $B(OH)_3 + NaOH \rightleftharpoons NaBO_2 + Na\left[B(OH)_4\right] + H_2O$ How can this reaction is made to proceed in forward direction?

(1) Addition of cis1, 2 diol (2) Addition of Borax

(3) Addition of trans-1, 2 diol (4) Addition of Na_2HPO_4

35 The state of hybridization of central atom in dimer form of both BH3 and BeH2 are respectively

(1) sp3, sp2 (2) sp3, sp3 (3) sp3, sp (4) sp2, sp2

36 Hybrid state of Aluminium in acidified aqueous solution of $AlCl_3$ is

(1) sp^3 (2) sp^3d (3) sp^3d^2 (4) sp^3d^3

37 (i) $Al \xrightarrow{N_2} A$ (ii) $Al \xrightarrow{C} B$ Here A & B on hydrolysis respectively gives :

(1) NH_3, C_2H_2 (2) NO, CH_4 (3) NH_3, CH_4 (4) NO, C_2H_2

38 Aluminium chloride exists as dimer, Al_2Cl_6 in solid state as well as in solution of non-polar solvent such as benzene. When dissolved in water it gives.

(1) $Al^{+3} + 3Cl^-$ (2) $\left[Al(H_2O_6)\right]^{+3} + 3Cl^-$

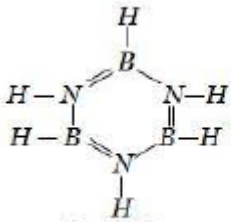
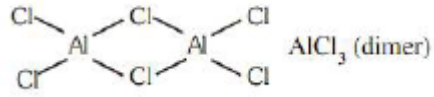
(3) $\left[Al(OH)_6\right]^{-3} + 3HCl$ (4) $Al_2O_3 + 6HCl$

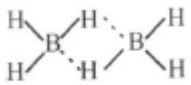
39	In electrolysis of Al_2O_3 by Hall-Heroult process (1) Cryolite (Na_2AlF_6) lowers the melting point of Al_2O_3 and increases its electrical conductivity (2) Al is obtained at cathode & O_2 at anode (3) Graphite anode is converted into CO_2 (4) All of these
40	An element (A) occurs in the short period having electronic configuration ns^2np^1. The formula of its oxide will be 1. AO_3 2. AO_2 3. A_2O_3 4. AO
41	In Goldschmidt aluminothermic process, thermite contains (1) 3 parts of Al_2O_3 and 4 parts of Al (2) 3 parts of Fe_2O_3 and 2 parts of Al (3) 3 parts Fe_2O_3 and 1 part of Al (4) 1 part Fe_2O_3 and 1 part of Al
42	The correct statement among the following is 1) B_2O_3 is an amphoteric oxide where as Al_2O_3 is an acidic oxide 2) 'Al' exhibits allotropy where as boron does not 3)Both boran and aluminium react with nitrogen to form nitrides which on hydrolysis give ammonia 4)Boron reacts with acids as well alkalies liberating hydrogen
43	Standard electrode potential values, $E^{\ominus}$ for Al^{3+}/Al is -1.66V and that of Tl^{3+}/Tl is +1.26V What does this indicate ? 1)Al has high tendency to form $Al^{3+}(aq)$ ions 2)Tl^{3+} is a powerful oxidising agent. 3) Al is more electropositive than thallium 4)All the above are true statements
44	Ionisation enthalpy $(\Delta_t H_i kJ\,mol^{-1})$ for the elements of group – 13follows the order 1)B > Al > Ga > In > TI 2)B < Al < Ga < In < TI 3)B < Al < Ga < In < TI 4)B > Al < Ga > In < TI

KEY

1	**ANS-1**
2	**ANS-1** : (1) Order of M.P $B > Al > Tl > In > Ga$
3	**ANS-2** : (2) Stability of +3 oxidation state decreases from Al to Tl. B always shows +3 oxidation state in all of its compounds.
4	

	: (1) $[BF_6]^{-3}$ not exist because maximum covalency of boron is 4
5	: (1) Boron nitride $(BN)_x$ resembles with graphite in structure
6	**ANS-1**
7	**ANS-3** : (3) B_2H_6 has two bridged hydrogens, which cannot be substituted
8	$B_3N_3H_4X_2$ shows position isomerism 1 ortho + 2 Meta + 1 para isomer = total 4 isomer.
9	: (1) Diborane (B_2H_6) has three centred two electron bond.
10	: (1) 95-98% pure amorphous boron is moissan boron
11	: (1) Borax glass is a mixture of $NaBO_2 + B_2O_3$
12	: (3) $B_3N_3H_6$ is inorganic benzene
13	: (3) : In B_2H_6 the hybridization of at boran $\rightarrow sp^3$
14	: (1) One $B-H-B$ having 2 electrons & two $B-H-B$ having 4 electrons
15	: (1) : General formula of Arachno boranes in B_nH_{n+6} n = no.of Boran atoms
16	: (4) $B(OH)_3$ units are joined together by hydrogen bonds.
17	: (1) : $B_2O_3 + CoO \rightarrow Co(BO_2)_2\,(blue)$ Cobalt meta borate

18	: (3) Cleavage reaction
19	: (4) B_2H_6 reacts with NH_3, 1° and 2° amines & form an ionic compound. However with 3° amine, B_2H_6 forms an adduct
20	: (1)  **Borazine** ∴ Borazine has 12σ and 3π bonds
21	**ANS-3**
22	**ANS-2**
23	: (3)  $AlCl_3$ (dimer)
24	**ANS-2**
25	**ANS-2**
26	**ANS-3** $BN + 3H_2O \rightarrow H_3BO_3 + NH_3$
27	**ANS-3**
28	**ANS-4**
29	**ANS-3**
30	**ANS-2**

	$BF_3 + 3LiBH_4 \rightarrow 3LiF + 2B_2H_6$
31	**ANS-1** Degree of Hydrolysis $\propto$ Covalent character order of covalent character $\Rightarrow BF < BCl_3 < BBr_3 < BI_3$
32	**ANS-4** Sol: B_2H_6 reacts with NH_3, 1° and 2° amines & form an ionic compound. However with 3° amine, B_2H_6 forms an adduct $B_2H_6 + 2N(CH_3)_3 \rightarrow 2(CH_3)_3N \rightarrow BH_3$
33	**ANS-3**  (3c–2e⁻ bond)
34	By addition of cis 1, 2 – dial the acidic nature of $B(OH)_3$ increases and reaction is more **ANS-1**
35	**ANS-1**
36	**ANS-3** $AlCl_3 + 6H_2O \rightarrow \underset{sp^3d^2}{\left[Al(H_2O)_6\right]^{+3}}_{(aq)} + 3Cl^-_{(aq)}$
37	**ANS-3** Hint: $A = AlN \xrightarrow{H_2O} NH_3$ $B = Al_4C_3 \xrightarrow{H_2O} CH_4$
38	**ANS-2** $Al_2Cl_6 + 12H_2O \rightarrow 2\left[Al(H_2O)_6\right]^{+3} + 6Cl^-_{(aq)}$
39	**ANS-4**
40	: (3) $A(ns^2np^1) = A^{+3}\ O^{+2} = A_2O_3$
41	**ANS-3**
42	**ANS-3**

43	**ANS-4**
44	**ANS-3**