INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 27

Total Marks : 59

Max. Time : 61 min.

Topic : p-Block Element (Boron & Carbon Family)

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to 3, 5 to 12, 14 to 17	(3 marks, 3 min.)	[45, 45]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Match the Following (no negative marking) Q. 13	(8 marks, 10 min.)	[8, 10]
True or False (no negative marking) Q.18	(2 marks, 2 min.)	[2, 2]

1. **Statement-1 :** $T\ell^{3+}$ acts as an oxidising agent.

Statement-2 : $T\ell^{+}$ is more stable than $T\ell^{3+}$ due to inert pair effect.

(A) Statement : 1 is True, Statement-2 is True ; Statement -2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statment-2 is True ; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

2. How many (maximum) of the 8 atoms of B_2H_6 can be taken in a plane :

(A) 4 (B) 6 (C) 8 (D) None of these

3. The number of possible isomers for disubstituted borazine, $B_3N_3H_4X_2$ is :

(A) 3 (B) 4 (C) 6 (D) 2

4.* Which species exist :

(A) $[BF_6]^{3-}$ (B) $[AlF_6]^{3-}$ (C) $[GaF_6]^{3-}$ (D) $[InF_6]^{3-}$

5. Which of the following is only acidic in nature :

(A) $Be(OH)_2$ (B) $Mg(OH)_2$ (C) $B(OH)_3$ (D) $Al(OH)_3$

6. In the following reaction : $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$:

(A) $B(OH)_3$ is a Lewis acid. (B) $B(OH)_3$ is a Lewis base.

(C) $B(OH)_3$ is amphoteric. (D) none is correct.

7. On the addition of mineral acid to an aqueous solution of borax, the compound formed is :

(A) borodihydride (B) orthoboric acid (C) metaboric acid (D) pyroboric acid

8. Aqueous solution containing 1 mole of borax reacts with 2 mole of acid. This is because of :

(A) formation of 2 mole of $B(OH)_3$ only.

(B) formation of 2 mole of $[B(OH)_4]^-$ only.

(C) formation of 1 mole each of $B(OH)_3$ and $[B(OH)_4]^-$.

(D) formation of 2 mole each of $[B(OH)_4]^-$ and $B(OH)_3$, of which only $[B(OH)_4]^-$ reacts with acid.

9. Pick up the wrong statement :

(A) Borax is used in the manufacture of optical glasses. (B) Borax is used as a flux.

(C) Borax is used as a water softener. (D) Borax is used as a fuel in rockets.

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10. Which of the following statement is correct for diborane :

(A) Small amines like NH_3, CH_3NH_2 give unsymmetrical cleavage of diborane.

(B) Large amines such as $(CH_3)_3N$ and pyridine gives symmetrical cleavage of diborane.

(C) Small as well as large amines both gives symmetrical cleavage of diborane.

(D) (A) and (B) both

11. From B_2H_6, all the following can be prepared except :

(A) H_3BO_3 (B) $[BH_2(NH_3)_2]^+ [BH_4]^-$ (C) $B_2(CH_3)_6$ (D) $NaBH_4$

12. The product obtained in the reaction of diborane with excess of ammonia at low temperature is :

(A) $B_2H_6 . NH_3$ (B) $B_2H_6 . 2NH_3$ (C) $(BN)_x$ (D) Borazine

13. Match the reactions listed in column-I with the product(s) listed in column-II :

	Column – I		**Column – II**
(A)	$B_2O_3 + H_2O$	(p)	H_3BO_3
(B)	$B_2H_6 + H_2O$	(q)	H_2
(C)	$B_3N_3H_6 + H_2O$	(r)	HCl
(D)	$BCl_3 + H_2O$	(s)	NH_3
		(t)	N_2

14. Aluminium does not react with :

(A) NaOH (B) conc. HCl (C) N_2 (D) conc. HNO_3

15. Aluminium vessels should not be washed with materials containing washing soda because :

(A) washing soda is expensive.

(B) washing soda is easily decomposed.

(C) washing soda reacts with aluminium to form soluble aluminate.

(D) washing soda reacts with aluminium to form insoluble aluminium oxide.

16. **Statement-1 :** Al $(OH)_3$ is amphoteric in nature.

Statement-2 : Al–O and O–H bonds can be broken with equal ease in $Al(OH)_3$.

(A) Statement : 1 is True, Statement-2 is True ; Statement -2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statment-2 is True ; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

17. Aqueous solution of potash alum is :

(A) alkalline (B) acidic (C) neutral (D) soapy

18. **True / False**

(i) Ethyl borate, $B(OC_2H_5)_3$ burns with green edged flame.

(ii) In sodium peroxoborate, each boron is sp^3 hybridised.

(iii) H_3BO_3 does not dissolve in aqueous HF.

(iv) The basic nature of the hydroxides of Group 13 decreases progressively down the group.

(v) Elemental Boron cannot be obtained from Van Arkel method.

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Answer Key

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1.	(A)	**2.**	(B)	**3.**	(B)	**4.***	(BCD)	**5.**	(C)
6.	(A)	**7.**	(B)	**8.**	(D)	**9.**	(D)	**10.**	(D)
11.	(C)	**12.**	(B)						
13.	(A – p) ; (B – p, q) ; (C – p, q, s) ; (D – p, r).					**14.**	(D)	**15.**	(C)
16.	(A)	**17.**	(B)						
18.	**(i)** True	**(ii)**	True	**(iii)**	False	**(iv)**	False	**(v)**	**False**

Hints & Solutions

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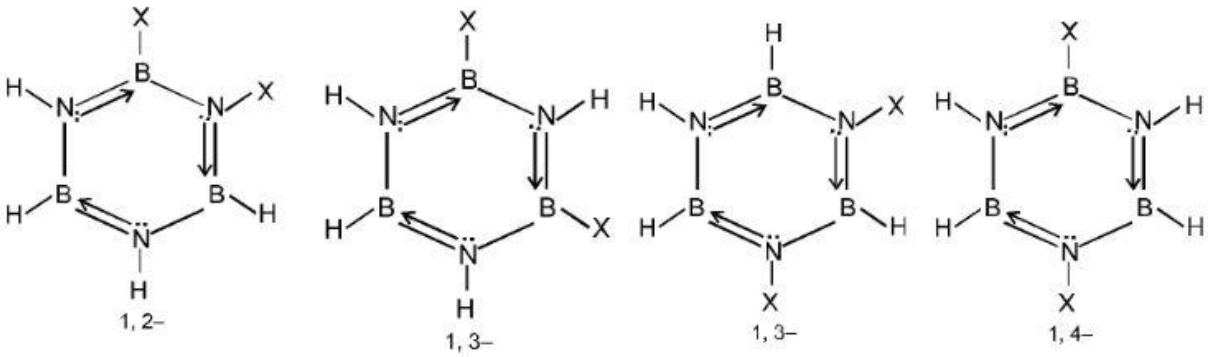
1. $T\ell^{3+}$ acts as an oxidising agent because it has tendency to reduce to $T\ell^{+}$ as +1 oxidation state of $T\ell$ is more stable on account inert pair effect.

3.



4.* Boron does not increase its covalence beyond four as it does not have d-orbital.

5. $B(OH)_3 + 2HOH \rightleftharpoons [B(OH)_4]^- + H_3O^+$.
In aqueous solution the boron completes its octet by accepting OH^- from water molecules. It therefore function as a weak monobasic lewis acid.

6. As boron completes it octet by accepting OH^- from water molecule. Hence it acts as a Lewis acid.

7. $Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$

8. $[B_4O_5(OH)_4]^{2-} + 5H_2O \rightleftharpoons 2B(OH)_3$ (weak acid) + $2[B(OH_4)]^-$ (salt)

9. Borax is not used as fuel in rockets.

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10. $B_2H_6 + 2NH_3 \longrightarrow [H_2B(NH_3)_2]^+ + [BH_4]^-$

$B_2H_6 + 2N(CH_3)_3 \longrightarrow 2H_3B \longleftarrow N(CH_3)_3$

11. (C) CH_3 group being larger can not form a bridge between two small sized boron atoms.

12. $B_2H_6 + NH_3 \xrightarrow[\text{low temperature}]{\text{Excess } NH_3} B_2H_6.\ 2NH_3$ or $[H_2B(NH_3)_2]^+\ [BH_4]^-$ (ionic compound).

13. (A) $B_2O_3 + 3H_2O \longrightarrow 2H_3BO_3$

(B) $B_2H_6 + 6H_2O \longrightarrow 2H_3BO_3 + 6H_2$

(C) $B_3N_3H_6 + 9H_2O \longrightarrow 3B(OH)_3 + 3NH_3 + 2H_2$

(D) $BCl_3 + 3H_2O \longrightarrow B(OH)_3 + 3HCl.$

14. As it becomes passive by the action of conc. HNO_3 forming a protective oxide layer on the surface.

15. $Na_2CO_3 + H_2O \longrightarrow 2NaOH + CO_2$; $4OH^- + Al \longrightarrow [Al(OH)_4]^-$ (soluble complex)

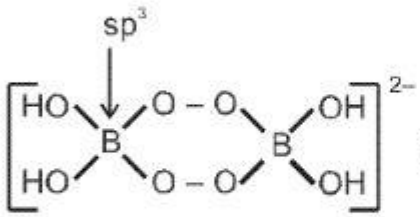
16. A (both assertion & reason are correct and explanation also correct)

17. It is acidic because of the hydrolysis of $Al_2(SO_4)_3$ according to the following reaction.

$Al_2(SO_4)_3 + 6H_2O \longrightarrow 2Al(OH)_3 + 3H_2SO_4.$

18. **(i)** This is the test of borate.

(ii)



Peroxoborate ion.

(iii) $H_3BO_3 + 4HF \longrightarrow H^+ + [BF_4]^- + 3H_2O$

(iv) False

(v) Elemental Boron can be obtained from Van Arkel method.

$2BI_3 \xrightarrow[\text{or Tantalum}]{\text{red hot W}} 2B\uparrow + 3I_2\uparrow$ (Van Arkel method).

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