

DPP - Daily Practice Problems

Name :

Date :

Start Time :

End Time :

CHEMISTRY

19

SYLLABUS : p-Block Elements (Gp-13)-1

Max. Marks : 120

Time : 60 min.

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deducted for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 Which of the following statements about H_3BO_3 is not correct?

- (a) It is a strong tribasic acid
- (b) It is prepared by acidifying an aqueous solution of borax
- (c) It has a layer structure in which planar BO_3 units are joined by hydrogen bonds
- (d) It does not act as proton donor but acts as a Lewis acid by accepting hydroxyl ion

Q.2 Identify the statement that is not correct as far as structure of diborane is concerned

- (a) There are two bridging hydrogen atoms in diborane

(b) Each boron atom forms four bonds in diborane

(c) The hydrogen atoms are not in the same plane in diborane

(d) All B - H bonds in diborane are similar

Q.3 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

- (a) $[\text{Al}(\text{OH})_6]^{3-} + 3\text{HCl}$
- (b) $2[\text{Al}(\text{H}_2\text{O})_6]^{3+} + 6\text{Cl}^-$
- (c) $\text{Al}^{3+} + 3\text{Cl}^-$
- (d) $\text{Al}_2\text{O}_3 + 6\text{HCl}$

Q.4 Boron forms covalent compounds due to

- (a) Higher ionization energy
- (b) Lower ionization energy
- (c) Small size
- (d) Both (a) and (c)

RESPONSE GRID

1. (a)(b)(c)(d) 2. (a)(b)(c)(d) 3. (a)(b)(c)(d) 4. (a)(b)(c)(d)

Q.5 Which of the following is formed when aluminium oxide and carbon are strongly heated in dry chlorine gas?

- (a) Aluminium chloride
- (b) Hydrated aluminium chloride
- (c) Anhydrous aluminium chloride
- (d) None of these

Q.6 Which of the statements about anhydrous aluminium chloride is correct?

- (a) It exists as AlCl_3 molecule
- (b) It is not easily hydrolysed
- (c) It sublimes at 100°C under vacuum
- (d) It is a strong Lewis base

Q.7 Aluminium vessels should not be washed with materials containing washing soda since

- (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

Q.8 Which one of the following is a correct statement?

- (a) The hydroxide of aluminium is more acidic than that of boron
- (b) The hydroxide of boron is basic, while that of aluminium is amphoteric
- (c) The hydroxide of boron is acidic, while that of aluminium is amphoteric
- (d) The hydroxides of boron and aluminium are amphoteric

Q.9 In the purification of bauxite by Hall's process

- (a) Bauxite ore is heated with NaOH solution at 50°C
- (b) Bauxite ore is fused with Na_2CO_3
- (c) Bauxite ore is fused with coke and heated at 1800°C in a current of nitrogen
- (d) Bauxite ore is heated with NaHCO_3

Q.10 For the electrolytic refining of aluminium, the three fused layers consist of

	Bottom Layer	Middle Layer	Upper Layer
(a)	Cathode of pure Al	Cryolite and fluorspar	Anode of Al and Cu alloy
(b)	Cathode of Al and Cu alloy	Bauxite and cryolite	Anode of pure Al
(c)	Anode of Al and Cu alloy	Cryolite and fluorspar	Cathode of pure Al
(d)	Anode of impure Al	Bauxite, cryolite and fluorspar	Cathode of pure Al

Q.11 For purification of alumina, the modern processes most useful when (i) the impurity present in a lot of iron oxides and (ii) the impurity present in a lot of silica, are

- (a) For (i) Hall's process; for (ii) Baeyer's process
- (b) For (i) Hall's process; for (ii) Serpeck's process
- (c) For (i) Serpeck's process; for (ii) Baeyer's process
- (d) For (i) Baeyer's process; for (ii) Serpeck's process

Q.12 In the electrolytic method of obtaining aluminium from purified bauxite, cryolite is added to the purified alumina in order to

- (a) Minimize the heat loss due to radiation
- (b) Protect aluminium from oxygen
- (c) Lower the melting point of the mixture and render it a conductor of electricity
- (d) Dissolve bauxite

Q.13 The structure of diborane (B_2H_6) contains

- (a) Four $2c-2e^-$ bonds and two $3c-2e^-$ bonds
- (b) Two $2c-2e^-$ bonds and four $3c-2e^-$ bonds
- (c) Two $2c-2e^-$ bonds and two $3c-3e^-$ bonds
- (d) Four $2c-2e^-$ bonds and four $3c-2e^-$ bonds

Q.14 Acidic strength of boron trihalides are in order

- (a) $\text{BF}_3 < \text{BCl}_3 < \text{BBR}_3 < \text{BI}_3$
- (b) $\text{BI}_3 < \text{BBR}_3 < \text{BCl}_3 < \text{BF}_3$
- (c) $\text{BBR}_3 < \text{BCl}_3 < \text{BF}_3 < \text{BI}_3$
- (d) $\text{BF}_3 < \text{BI}_3 < \text{BCl}_3 < \text{BBR}_3$

**RESPONSE
GRID**

5. (a)(b)(c)(d)

6. (a)(b)(c)(d)

7. (a)(b)(c)(d)

8. (a)(b)(c)(d)

9. (a)(b)(c)(d)

10. (a)(b)(c)(d)

11. (a)(b)(c)(d)

12. (a)(b)(c)(d)

13. (a)(b)(c)(d)

14. (a)(b)(c)(d)

Q.15 In the Hoope's process for refining of aluminium, the fused materials form three different layers and they remain separated during electrolysis also. This is because

- The upper layer is kept attracted by the cathode and the lower layer is kept attracted by the anode
- There is special arrangement in the cell to keep the layers separate
- The 3 layers have different densities
- The 3 layers are maintained at different temperatures

Q.16 In the commercial electrochemical process for aluminium extraction, the electrolyte used is

- $\text{Al}(\text{OH})_3$ in NaOH solution
- An aqueous solution of $\text{Al}_2(\text{SO}_4)_3$
- A molten mixture of Al_2O_3 and Na_3AlF_6
- A molten mixture of $\text{AlO}(\text{OH})$ and $\text{Al}(\text{OH})_3$

Q.17 Aluminium is more reactive than iron. But aluminium is less easily corroded than iron because

- Aluminium is a noble metal
- Oxygen forms a protective oxide layer
- Iron undergoes reaction easily with water
- Iron forms mono and divalent ions

Q.18 Aluminium (III) chloride forms a dimer because

- Higher coordination number can be achieved by aluminium
- Aluminium has high ionization energy
- Aluminium belongs to III group
- It cannot form a trimer

Q.19 Aluminium is obtained by

- Reducing Al_2O_3 with coke
- Electrolysing Al_2O_3 dissolved in Na_3AlF_6
- Reducing Al_2O_3 with chromium
- Heating alumina and cryolite

Q.20 In diborane, the two $\text{H}-\text{B}-\text{H}$ angles are nearly

- $60^\circ, 120^\circ$
- $95^\circ, 120^\circ$
- $95^\circ, 150^\circ$
- $120^\circ, 180^\circ$

Q.21 When orthoboric acid (H_3BO_3) is heated, the residue left is

- Metaboric acid
- Boron
- Boric anhydride
- Borax

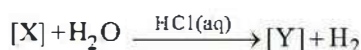
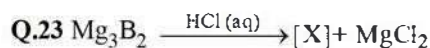
DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes:

- 1, 2 and 3 are correct
- 1 and 2 are correct
- 2 and 4 are correct
- 1 and 3 are correct

Q.22 Select the correct statements for diborane :

- Boron is approximately sp^3 hybridized
- There are only 12 bonding electrons
- There are two terminal $\text{B}-\text{H}$ bonds for each boron atom
- $\text{B}-\text{H}-\text{B}$ angle is 180°



For $[\text{X}]$ and $[\text{Y}]$ the correct choice is :

- $[\text{X}]$ is B_2H_6 and $[\text{Y}]$ is H_3BO_3
- $[\text{X}]$ with air and $[\text{Y}]$ on strong heating (red heat) give same compound.
- In $[\text{Y}]$, B completes its octet by removing OH^- from water molecule.
- $[\text{X}]$ is BCl_3 and $[\text{Y}]$ is H_3BO_3

Q.24 Which of the following statements about anhydrous aluminium chloride is correct ?

- It fumes in moist air
- It exists as dimer both in the vapour state below 350°C and in non-polar solvents
- It is prepared by heating Al_2O_3 in a stream of sulphur chloride (S_2Cl_2) vapour and chlorine
- It sublimes at 250°C

**RESPONSE
GRID**

15. (a)(b)(c)(d)

16. (a)(b)(c)(d)

17. (a)(b)(c)(d)

18. (a)(b)(c)(d)

19. (a)(b)(c)(d)

20. (a)(b)(c)(d)

21. (a)(b)(c)(d)

22. (a)(b)(c)(d)

23. (a)(b)(c)(d)

24. (a)(b)(c)(d)

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

Compound X on reduction with LiAlH_4 gives a boron hydride (Y) containing 21.72% hydrogen along with other products. The compound (Y) reacts with air explosively resulting in a compound (Z)

Q.25 X is

- (a) BX_3 (b) B_2H_6
(c) B_2O_3 (d) BH_3

Q.26 Y is

- (a) BX_3 (b) B_2H_6
(c) B_2O_3 (d) BH_3

Q.27 Z is

- (a) BX_3 (b) B_2H_6
(c) B_2O_3 (d) BH_3

DIRECTIONS (Q.28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

- (a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement - 1 is False, Statement-2 is True.
(d) Statement - 1 is True, Statement-2 is False.

Q.28 Statement 1 : Boron is a metalloid.

Statement 2 : Boron shows metallic nature.

Q.29 Statement 1 : Al forms $[\text{AlF}_6]^{3-}$ but B does not form $[\text{BF}_6]^{3-}$.

Statement 2 : 'B' does not react with F_2 .

Q.30 Statement 1 : Borax bead test is not suitable for Al(III).

Statement 2 : Al_2O_3 is insoluble in water.

**RESPONSE
GRID**

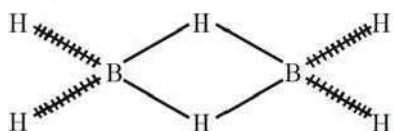
25. (a) (b) (c) (d) 26. (a) (b) (c) (d) 27. (a) (b) (c) (d) 28. (a) (b) (c) (d) 29. (a) (b) (c) (d)
30. (a) (b) (c) (d)

DAILY PRACTICE PROBLEM SHEET 19 - CHEMISTRY

Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	64
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

- (1) (a) Boric acid is a weak monobasic acid as it is not able to release H^+ ions on its own. It receives OH^- ions from water to complete its octet and in turn releases H^+ ions.

- (2) (d) B_2H_6 has two types of B - H bonds.



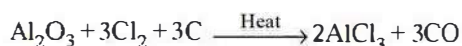
B 119pm H (Terminal bond)

B 134pm H (Bridge bond)

- (3) (b) $Al_2Cl_6 + 12H_2O \rightarrow 2[Al(H_2O)_6]^{3+} + 6Cl^-$

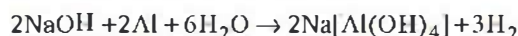
- (4) (d) Boron forms only covalent compounds due to its exceptionally small size and high I.E.

- (5) (c) The reaction is :



- (6) (c) Anhydrous $AlCl_3$ exists as a dimer and being electron deficient, it acts as a Lewis acid. Also, it is hydrolysed by atmospheric moisture to liberate HCl gas. Thus, options (a), (b) and (d) are incorrect. Only (c) is correct option.

- (7) (c) $Na_2CO_3 + H_2O \rightarrow 2NaOH + CO_2$



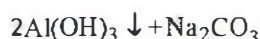
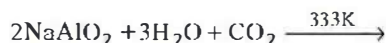
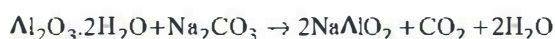
- (8) (c) $B(OH)_3$ dissolves in alkalis forming metal borates, i.e.



$Al(OH)_3$ is amphoteric. It dissolves in acids as well as bases :



- (9) (b) In Hall's process

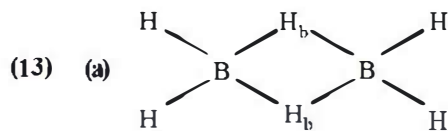


- (10) (c)

- (11) (d) Iron oxide impurity - Baeyer's process

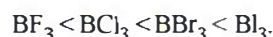
Silica impurity - Serpeck's process

- (12) (c) In electrolytic method of obtaining aluminium from purified bauxite, cryolite is added to the charge because it reduces the melting point of bauxite (from $1200^\circ C$ to $800^\circ C - 900^\circ C$) and also increases electrical conductivity of the mixture.



Two $3c-2e^-$: B - H_b - B; Four $2c-2e^-$: H_t - B - H_t

- (14) (a) The strength of Lewis acid of boron trihalides increases in the following order:



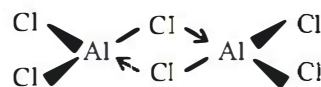
This is due to back-donation in BF_3 (from three F-atoms into vacant $2p$ -orbital of B) due to which the electron deficiency of B decreases and thus BF_3 is weakest Lewis acid. As the size of halogen increases, the extent of overlap between $2p$ -orbital of B and bigger p -orbital of halogen decreases and consequently electron-deficiency of B increases and Lewis acid character also increases.

- (15) (c)

- (16) (c)

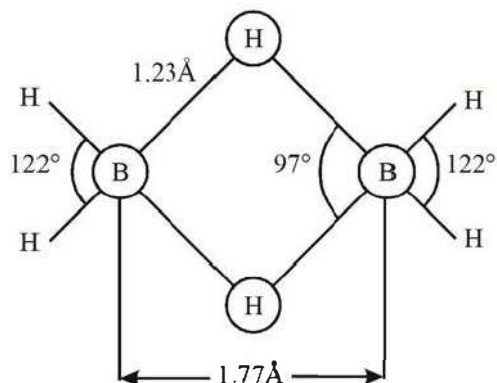
- (17) (b)

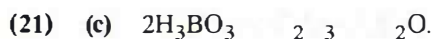
- (18) (a) Due to its bigger size and availability of vacant d -orbitals, Al can easily accommodate four big sized Cl atoms around it. Since in $AlCl_3$, there are only six electrons around Al-atom, therefore, it completes its octet by accepting a lone pair of electrons from Cl atom of another $AlCl_3$ molecule resulting in a bridged dimeric structure.



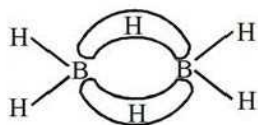
- (19) (b)

- (20) (b) Dilthey in 1921 proposed a bridge structure for diborane. Four hydrogen atoms, two on the left and two on the right, known as terminal hydrogens and two boron atoms lie in the same plane. Two hydrogen atoms forming bridges, one above and other below, lie in a plane perpendicular to the rest of molecule.





(22) (a)

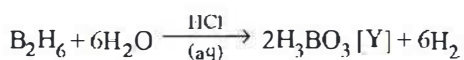
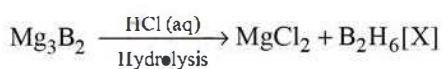


B is sp^3 hybridized

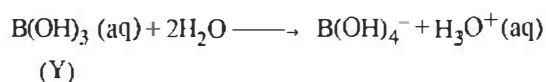
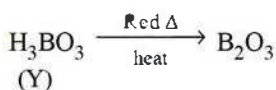
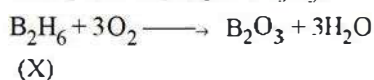
Only 12 bonding electrons available

BHB angle is 97° not 180° .

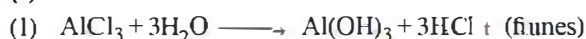
(23) (a)



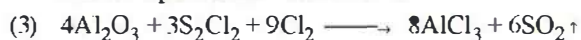
Both [X] and [Y] gives B_3O_3 ,



(24) (a)



(2) It exists as dimer in non-polar solvents like benzene and in vapour state below 350°C .

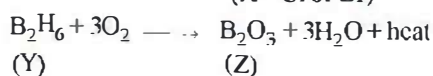
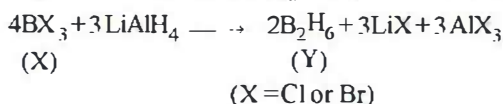


(4) Anhydrous AlCl_3 sublimes at 100°C .

Hence option (4) is incorrect.

(25)(a), 26 (b), 27 (c)

Reduction of (X) with LiAlH_4 gives a boron hydride (Y) having 21.72% hydrogen; (Y) should be B_2H_6 and hence (X) as boron trihalide, BX_3 . The reactions are shown as :



(28) (d) Boron is a metalloid. Thus statement-1 is correct. Metalloids possess, metallic as well as non-metallic nature. Hence, statement-2 is false.

(29) (d) Statement-1 is true but statement-2 is false.

B does not have vacant d-orbitals as second shell is the outermost shell.

(30) (b) Borax bead test is not suitable for Al(III) because its oxidising as well as reducing flame is colourless in both hot as well as cold.

Alumina is insoluble in water as they exist in hydrated form like $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$, etc.