

THE p-BLOCK ELEMENTS (GROUPS 13 AND 14)



MCQs with One Correct Answer

- H_3BO_3 on heating up to 373 K yields
 - boric anhydride
 - orthoboric acid
 - metaboric acid
 - tetraboric acid
- 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
 - $[\text{Al}(\text{OH})_6]^{3-} + 3\text{HCl}$
 - $[\text{Al}(\text{H}_2\text{O})_6]^{3+} + 3\text{Cl}^-$
 - $\text{Al}^{3+} + 3\text{Cl}^-$
 - $\text{Al}_2\text{O}_3 + 6\text{HCl}$
- In reaction $\text{BF}_3 + 3\text{LiBH}_4 \rightarrow 3\text{LiF} + \text{X}$; X is
 - B_4H_{10}
 - B_2H_6
 - BH_3
 - B_3H_8
- The role of fluorspar (CaF_2) which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite (Na_3AlF_6) is
 - as a catalyst
 - to make the fused mixture very conducting
 - to increase the temperature of the melt.
 - to decrease the rate of oxidation of carbon at the anode.
- The dissolution of $\text{Al}(\text{OH})_3$ by a solution of NaOH results in the formation of
 - $[\text{Al}(\text{H}_2\text{O})_4(\text{OH})]^{2+}$
 - $[\text{Al}(\text{H}_2\text{O})_2(\text{OH})_4]^-$
 - $[\text{Al}(\text{H}_2\text{O})_3(\text{OH})_3]$
 - $[\text{Al}(\text{H}_2\text{O})_6(\text{OH})_3]$
- $\text{BX}_3 + \text{NH}_3 \xrightarrow{\text{R.T.}} \text{BX}_3 \cdot \text{NH}_3 + \text{Heat of adduct formation } (\Delta H)$
The numerical value of ΔH is found to be maximum for :
 - BF_3
 - BCl_3
 - BBr_3
 - BI_3

7. When aluminium is heated in atmosphere of nitrogen it forms :
 (a) AlN (b) Al₂N
 (c) Al₃N (d) Al₂N₃
8. Diborane is prepared on large scale by
 (a) $2\text{BF}_3(\text{g}) + 6\text{LiH}(\text{s}) \xrightarrow{450\text{ K}} \text{B}_2\text{H}_6(\text{g}) + 6\text{LiF}(\text{s})$
 (b) $2\text{BCl}_3(\text{g}) + 6\text{LiH}(\text{s}) \xrightarrow{450\text{ K}} \text{B}_2\text{H}_6(\text{g}) + 6\text{LiCl}(\text{s})$
 (c) $2\text{BF}_3(\text{g}) + 6\text{NaH} \xrightarrow{450\text{ K}} \text{B}_2\text{H}_6 + 6\text{NaF}$
 (d) $2\text{BCl}_3 + 6\text{NaH} \xrightarrow{450\text{ K}} \text{B}_2\text{H}_6 + 6\text{NaCl}$
9. Silicon dioxide is formed by the reaction of
 (a) SiCl₄ + H₂O
 (b) SiO₂ + HF
 (c) SiO₂ + NaOH
 (d) SiCl₄ + NaOH
10. SiF₄ gets hydrolysed giving.....
 (a) SiO₂ (b) Si(OH)₂F₂
 (c) H₂SiF₆ (d) Si(OH)₄
11. Soldiers of Napoleon 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
 (a) a change in the partial pressure of oxygen in the air
 (b) a change in the crystalline structure of tin
 (c) an interaction with nitrogen of the air at very low temperatures
 (d) an interaction with water vapours contained in the humid air
12. The tendency of X in BX₃ (X = F, Cl, OMe, NMe) to form a π - bond with boron follows the order
 (a) BCl₃ < BF₃ < B(OMe)₃ < B(NMe₂)₃
 (b) BF₃ < BCl₃ < B(OMe)₃ < B(NMe₂)₃
 (c) BCl₃ < B(NMe₂)₃ < B(OMe)₃ < BF₃
 (d) BCl₃ < BF₃ < B(NMe₂)₃ < B(OMe)₃
13. PbO₂ is obtained from
 (a) the reaction of PbO with HCl
 (b) thermal decomposition of Pb(NO₃)₂ at 200 °C
 (c) the reaction of Pb₃O₄ with HNO₃
 (d) the reaction of Pb with air at room temperature
14. An allotrope of carbon which exhibits only two types of C – C bond distance of 143.5 pm and 138.3 pm, is
 (a) charcoal (b) graphite
 (c) diamond (d) fullerene
15. A solid element (symbol Y) conducts electricity and forms two chlorides YCl_n (colourless volatile liquid) and YCl_{n-2} (a colourless solid). To which one of the following groups of the periodic table does Y belong?
 (a) 13 (b) 14
 (c) 15 (d) 16
16. The reducing power of divalent species decreases in the order
 (a) Ge > Sn > Pb
 (b) Sn > Ge > Pb
 (c) Pb > Sn > Ge
 (d) None of these
17. The gas evolved on heating CaF₂ and SiO₂ with concentrated H₂SO₄ on hydrolysis gives a white gelatinous precipitate. The precipitate is
 (a) hydrofluorosilicic acid
 (b) silica gel
 (c) silicic acid
 (d) calciumfluorosilicate
18. On heating Pb(NO₃)₂, the products formed are:
 (a) PbO, N₂, O₂ (b) Pb(NO₂)₂, O₂
 (c) PbO, NO₂, O₂ (d) Pb, N₂, O₂
19. The product of the following reaction are:
 $\text{SiO}_2 + \text{C} \xrightarrow{\Delta} \text{Products}$
 (a) SiC and CO₂ (b) SiO and CO
 (c) SiC and CO (d) Si and CO

20. What is not correct about carbon monoxide ?
- Carbon in CO is sp hybridised and is linear molecule
 - CO is a ligand because it has a lone pair of electrons on the carbon atom
 - CO is the reducing agent in metallurgy of iron
 - CO has the structure C = O
21. In aluminates, the coordination number of Al is
22. How many oxides of the following are non-amphoteric in nature?
CO₂, SiO₂, SnO₂ and CaO
23. How many orbitals of boron are involved in hybridisation in B₂H₆?
24. In a molecule of C₆₀ Buckminsterfullerene, what is the sum of six-membered and five-membered rings?
25. What is the sum for the molecular masses of constituents of producer gas?

Numeric Value Answer

ANSWER KEY																	
1	(c)	4	(b)	7	(a)	10	(d)	13	(c)	16	(a)	19	(c)	22	(3)	25	(56)
2	(b)	5	(b)	8	(a)	11	(b)	14	(d)	17	(d)	20	(d)	23	(4)		
3	(b)	6	(d)	9	(a)	12	(a)	15	(b)	18	(c)	21	(6)	24	(32)		

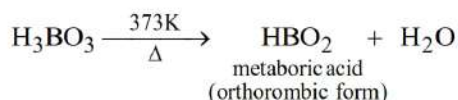
Hints & Solutions

CHAPTER

11

The p-Block Elements (Groups 13 and 14)

1. (c) H_3BO_3 on heating at 373K yields metaboric acid (HBO_2)



2. (b) $\text{Al}_2\text{Cl}_6 + 12\text{H}_2\text{O} \rightleftharpoons 2[\text{Al}(\text{H}_2\text{O})_6]^{3+} + 6\text{Cl}^-$

3. (b)

4. (b) CaF_2 when added to fused cryolite, lowers the m.p. and increases the conductivity.

5. (b) $\text{Al}(\text{OH})_3 + \text{OH}^- \rightarrow [\text{Al}(\text{OH})_4]^-$

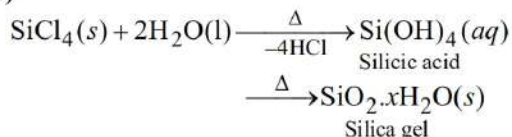


6. (d) Lewis acidic strength: $\text{BF}_3 < \text{BCl}_3 < \text{BBr}_3 < \text{BI}_3$
As BI_3 is strongest Lewis acid among all boron halides therefore, heat of adduct formation will be the maximum numerically, for BI_3 .

7. (a) $2\text{Al} + \text{N}_2 \xrightarrow{\Delta} 2\text{AlN}$

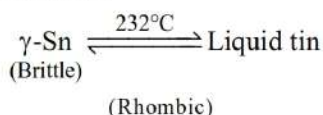
8. (a)

9. (a)



10. (d) It is hydrolysed with water to form a $\text{Si}(\text{OH})_4$.

11. (b) $\alpha\text{-tin} \xrightleftharpoons{15.2^\circ\text{C}} \underset{\substack{\text{(White)}}}{\beta\text{-Sn}} \xrightleftharpoons{164^\circ\text{C}} \gamma\text{-Sn}$
(Grey) (most common and stable)



Although transitions of white to grey tin occurs at any temperature below 15.2°C , it becomes rapid only at -50°C , unless a catalyst is present. During the conversion of white tin to grey tin (in cold countries) volume increases. Grey Sn is very brittle easily crumbles down to powder. This phenomenon is called tin diseases, tin pest or tin plague.

12. (a) Lesser electronegativity of X and similar size of valence shell of X and B favours back bonding.

Cl and F are more electronegative than OMe and NMe group and Cl have large size of 3p-orbital.

Among $\text{B}(\text{OMe})_3$ and $\text{B}(\text{NMe}_2)_3$, N in NMe is less electronegative than O in OMe group. Thus, the tendency to form π -bond with boron follows the order.



13. (c) $\text{Pb}_3\text{O}_4 + 4\text{HNO}_3 \rightarrow 2\text{Pb}(\text{NO}_3)_2 + \text{PbO}_2 + 2\text{H}_2\text{O}$

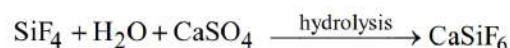
14. (d) Fullerene contains both single and double bond with C-C at a distance of 143.5 pm and 138.3 pm.

15. (b) SnCl_4 is colourless volatile liquid and SnCl_2 is colourless solid Sn conducts electricity and it belongs to 14 group.

16. (a) The stability of +2O.S. follows the order $\text{Pb}^{2+} > \text{Sn}^{2+} > \text{Ge}^{2+}$

Hence reducing power $\text{Ge} > \text{Sn} > \text{Pb}$

17. (d) $2\text{CaF}_2 + \text{SiO}_2 + \text{H}_2\text{SO}_4 \longrightarrow$



18. (c) $\text{Pb}(\text{NO}_3)_2 \xrightarrow{\Delta} \text{PbO} + 2\text{NO}_2 + \frac{1}{2}\text{O}_2$
19. (c) $\text{SiO}_2 + 3\text{C} \longrightarrow \text{SiC} + 2\text{CO}$
20. (d) CO molecule is linear ($\text{C} \equiv \text{O}$) and it is supposed that carbon atom in it is sp-hybridised. CO is electron deficient molecule and has π acceptor properties. Due to presence of pair of electrons, it acts as ligand or Lewis base. In metallurgy it is used as reducing agent.
21. (6) In aqueous solution the probable aluminate species is $[\text{Al}(\text{H}_2\text{O})_2(\text{OH})_4]^-$, hence, co-ordination number of Al is 6.
22. (3) CO_2 , SiO_2 acidic CaO basic and SnO_2 amphoteric.
23. (4) Boron in B_2H_6 is sp^3 hybridised and hence four orbitals are involved.
24. (32) It contains 20 six-membered rings and 12 five-membered rings.
Total no. of rings = $20 + 12 = 32$
25. (56) Producer gas is $\text{CO} + \text{N}_2$.
Sum of molecular mass = $(16 + 12) + (14 + 14) = 56$