DPP - Daily Practice Problems

Chapter-wise Sheets

Date : Start Time : End Time :

CHEMISTRY CC11

SYLLABUS : p-Blcok Elements

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Which of the following hydroxide is acidic ?
(a) $Al(OH)_3$ (b) $Ca(OH)_3$
(c) $Tl(OH)_3$ (d) $B(OH)_3$

2. Boric acid is polymeric due to
(a) its acidic nature
(b) the presence of hydrogen bonds
(c) its monobasic nature
(d) its geometry

3. The $I.E_1$ among the group 13 member follows as
(a) B>Al<Ga<Tl (b) B>Al>Ga>Tl
(c) B>Ga>Al>Tl (d) B>Ga<Al<Tl

4. In aluminates, the coordination number of Al is
(a) 4 (b) 6
(c) 3 (d) 1

5. Match the columns

	Column-I		Column-II
A.	Carbon	I.	Metal
B.	Silicon	II.	Non-metal
C.	Germanium	III.	Metalloid
D.	Tin		
E	Lead		

(a) A – II; B – II; C – III; D – I; E – I
(b) A – II; B – III; C – III; D – I; E – I
(c) A – I; B – III; C – III; D – I; E – II
(d) A – I; B – II; C – II; D – III; E – I

6. The melting pt. of group 13 follows the order
(a) B>Al>Ga>In>Tl (b) B>Al<Ga>In>Tl
(c) B>Al>Tl>In>Ga (d) B>Al<Ga<In<Tl

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ
	6. ⓐⓑⓒⓓ				

Space for Rough Work

7. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence
   (a) $PbX_2 << SnX_2 << GeX_2 << SiX_2$
   (b) $GeX_2 << SiX_2 << SnX_2 << PbX_2$
   (c) $SiX_2 << GeX_2 << PbX_2 << SnX_2$
   (d) $SiX_2 << GeX_2 << SnX_2 << PbX_2$.

8. The catenation tendency of C,Si and Ge is in the order Ge < Si < C. The bond energies (in kJ mol^{-1}) of C-C,Si-Si and Ge-Ge bonds, respectively are
   (a) 167, 180, 348 (b) 180, 167, 348
   (c) 348, 167, 180 (d) 348, 180, 167

9. Which is not the use of orthoboric acid?
   (a) As an antiseptic and eye wash.
   (b) In glass industry.
   (c) In glazes for pottery.
   (d) In borax - bead test.

10. On adding ammonium hydroxide solution to $Al_2(SO_4)_3$(aq):
   (a) A precipitate is formed which does not dissolve in excess of ammonium hydroxide
   (b) A precipitate is formed which dissolves in excess of ammonia solution
   (c) No precipitate is formed
   (d) None of these

11. Heating an aqueous solution of aluminium chloride to dryness will give
   (a) $Al(OH)Cl_2$ (b) Al_2O_3
   (c) Al_2Cl_6 (d) $AlCl_3$

12. Which of the following statement(s) is/are incorrect ?
   (i) Higher boranes are not flammable.
   (ii) Boranes are hydrolysed by water to give orthoboric acid.
   (iii) Boranes undergoes cleavage reactions with Lewis bases to give borane adducts.
   (a) (i) only (b) (ii) and (iii)
   (c) (iii) only (d) (i) and (ii)

13. Which among the following oxides react with alkali?
   B_2O_3, Al_2O_3 and Tl_2O
   (a) B_2O_3 and Al_2O_3 (b) Al_2O_3 and Tl_2O
   (c) Only B_2O_3 (d) B_2O_3 and Tl_2O

14. In the following sets of reactants which two sets best exhibit the amphoteric characters of $Al_2O_3.xH_2O$?
   Set 1: $Al_2O_3.xH_2O$ (s) and OH^- (aq)
   Set 2: $Al_2O_3.xH_2O$ (s) and H_2O (*l*)
   Set 3: $Al_2O_3.xH_2O$ (s) and H^+ (aq)
   Set 4: $Al_2O_3.xH_2O$ (s) and NH_3 (aq)
   (a) 1 and 2 (b) 1 and 3
   (c) 2 and 4 (d) 3 and 4

15. Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of:
   (a) $Al_2O_3 + HF + NaAlF_4$
   (b) $Al_2O_3 + CaF_2 + NaAlF_4$
   (c) $Al_2O_3 + Na_3AlF_6 + CaF_2$
   (d) $Al_2O_3 + KF + Na_3AlF_6$

16. Which of the following has the minimum heat of dissociation:
   (a) $(CH_3)_3N: \rightarrow BF_3$
   (b) $(CH_3)_3N: \rightarrow B(CH_3)_2F$
   (c) $(CH_3)_3N: \rightarrow B(CH_3)_3$
   (d) $(CH_3)_3N: \rightarrow B(CH_3)F_2$

17. The hybridisation of boron atom in orthoboric acid is
   (a) sp (b) sp^2
   (c) sp^3 (d) sp^3d

18. Which among the following can act as reducing agent (A)$SnCl_2$, (B)CO and (C)$PbCl_2$?
   (a) (A) and (B) (b) (B) and (C)
   (c) (C) and (A) (d) Only (B)

19. What is the oxidation state and hybridisation of boron in compound formed when BCl_3 undergoes reaction with the water?
   (a) 3, sp^2d (b) 3, sp^3
   (c) 4, sp^3 (d) 3, sp^2d

RESPONSE GRID					
	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)	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)		

Space for Rough Work

20. Identify the statement that is not correct as far as structure of diborane is concerned
(a) There are two bridging hydrogen atoms and four terminal 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

21. Specify the coordination geometry around and hybridization of N and B atoms in a 1 : 1 complex of BF_3 and NH_3
(a) N : tetrahedral, sp^3; B : tetrahedral, sp^3
(b) N : pyramidal, sp^3; B : pyramidal, sp^3
(c) N : pyramidal, sp^3; B : planar, sp^3
(d) N : pyramidal, sp^3; B : tetrahedral, sp^3

22. Which of the following shows bond in silicon :
(a) Si–Si–Si–Si (b) –Si–O–Si–O–Si
(c) Si–C–Si–C–Si (d) Si–C–Si–O–Si

23. CO_2 and N_2 are non-supporters of combustion. However for putting out fires CO_2 is preferred over N_2 because CO_2
(a) does not burn
(b) forms non-combustible products with burning substances
(c) is denser than nitrogen
(d) is a more reactive gas

24. Which of the following statement(s) is/are incorrect ?
(i) Trichlorides on hydrolysis in water form tetrahedral $[M(OH)_4]^-$ species.
(ii) Hybridisation state of metal in tetrahedral species is sp^3.
(iii) Aluminium chloride in acidified aqueous solution forms $[Al(OH)_4]^-$ ion.
(a) (i) and (ii) (b) (ii) only
(c) (iii) only (d) (i) and (iii)

25. _____ helps to maintain pH of blood between 7.26 to 7.42
(a) CO_2 (b) H_2CO_3
(c) CO_3^{2-} (d) H_2CO_3/HCO_3^-

26. 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
(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 temperature
(d) an interaction with water vapour contained in the humid air

27. On addition of excess of sodium hydroxide solution to stannous chloride solution, we obtain :
(a) $Sn(OH)_2$ (b) $SnO_2.H_2O$
(c) Na_2SnO_2 (d) None of these

28. 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

29. The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4, on hydrolysis gives a white gelatinous precipitate. The precipitate is:
(a) hydrofluosilicic acid (b) silica gel
(c) silicic acid (d) calciumfluorosilicate

30. In view of the signs of $\Delta_r G^\circ$ for the following reactions :
$PbO_2 + Pb \rightarrow 2PbO, \quad \Delta_r G^\circ < 0$
$SnO_2 + Sn \rightarrow 2SnO, \quad \Delta_r G^\circ > 0$
Which oxidation states are more characteristics for lead and tin ?
(a) For lead + 2, for tin + 2 (b) For lead + 4, for tin + 4
(c) For lead + 2, for tin + 4 (d) For lead + 4, for tin + 2

31. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct?
(a) MCl_2 is more ionic than MCl_4
(b) MCl_2 is more easily hydrolysed than MCl_4
(c) MCl_2 is more volatile than MCl_4
(d) MCl_2 is more soluble in anhydrous ethanol than MCl_4

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ	**28.** ⓐⓑⓒⓓ	**29.** ⓐⓑⓒⓓ
	30. ⓐⓑⓒⓓ	**31.** ⓐⓑⓒⓓ			

Space for Rough Work

32. 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 a lone pair of electrons.

33. Pyrosilicate ion is

(a) SiO_2^{2-} (b) SiO_4^{2-} (c) $Si_2O_6^{7-}$ (d) $Si_2O_7^{6-}$

34. For making good quality mirrors, plates of float glass are used. These are obtained by floating molten glass over a liquid metal which does not solidify before glass. The metal used can be

(a) tin (b) sodium

(c) magnesium (d) mercury

35. PbF_4, $PbCl_4$ exist but $PbBr_4$ and PbI_4 do not exist because of

(a) large size of Br^- and I^-

(b) strong oxidising character of Pb^{4+}

(c) strong reducing character of Pb^{4+}

(d) low electronegativity of Br^- and I^-.

36. Ge(II) compounds are powerful reducing agents whereas Pb(IV) compounds are strong oxidants .It is because

(a) Pb is more electropositive than Ge

(b) ionization potential of lead is less than that of Ge

(c) ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+}

(d) of more pronounced inert pair effect in lead than in Ge

37. The structure and hybridization of $Si(CH_3)_4$ is

(a) Bent, sp (b) Trigonal, sp^2

(c) Octahedral, d^2sp^3 (d) Tetrahedral, sp^3

38. In reaction

$$8BF_3 + 6LiH \xrightarrow{\Delta} X + LiBF_4$$

(a) B_4H_{10} (b) B_2H_6 (c) BH_3 (d) B_3H_8

39. Which of the following gas is used in artificial respiration ?

(a) O_2 (b) CO_2

(c) Helium (d) All of these

40. Graphite conducts electricity because of

(a) weak van der Waal's forces between layers

(b) covalent bonding between carbon atoms of layers

(c) delocalized electrons in each layer

(d) sp^2 hybridisation of carbon atoms in a layer

41. A group 14 element is oxidised to form corresponding oxide which is gaseous in nature, when dissolved in water pH of the water decreases further addition of group 2 hydroxides leads to precipitation. This oxide can be

(a) GeO_2 (b) CO

(c) CO_2 (d) SnO_2

42. Carborundum is

(a) $Al_2(SO_4)_3$ (b) $Al_2O_3.2H_2O$

(c) $AlCl_3$ (d) SiC

43. R_3SiCl on hydrolysis forms

(a) R_3SiOH (b) $R_3Si-O-SiR_3$

(c) $R_2Si=O$ (d) None of these

44. Which of the following species exists (A) $[SiF_6]^{2-}$, (B) $[GeCl_6]^{2-}$ and (C) $[CCl_6]^{2-}$?

(a) (A) and (B) (b) (B)and(C)

(c) Only(C) (d) (A) and (C)

45. Which of the following attacks glass

(a) HCl (b) HF

(c) HI (d) HBr

RESPONSE GRID					
	32. ⓐⓑⓒⓓ	**33.** ⓐⓑⓒⓓ	**34.** ⓐⓑⓒⓓ	**35.** ⓐⓑⓒⓓ	**36.** ⓐⓑⓒⓓ
	37. ⓐⓑⓒⓓ	**38.** ⓐⓑⓒⓓ	**39.** ⓐⓑⓒⓓ	**40.** ⓐⓑⓒⓓ	**41.** ⓐⓑⓒⓓ
	42. ⓐⓑⓒⓓ	**43.** ⓐⓑⓒⓓ	**44.** ⓐⓑⓒⓓ	**45.** ⓐⓑⓒⓓ	

Space for Rough Work

DAILY PRACTICE PROBLEMS — CHEMISTRY SOLUTIONS — DPP/CC11

1. **(d)** $B(OH)_3$ is acid because it can take OH^- ions.

H_3BO_3 or $B(OH)_3 + OH^- \rightarrow B(OH)_4^-$

2. **(b)** In Boric acid each B atom is sp^2 hybridized and contains BO_3^{3-} units which are held together by hydrogen bonds.

3. **(c)** The IE_1 of Ga is more than that of Al because of the small atomic size and greater effective nuclear charge of Ga.

4. **(b)** In aqueous solution the probable aluminate species is $[Al(H_2O)_2(OH)_4]$ hence Al containing co-ordination number 6.

5. **(b)** Carbon is non-metal. Germanium and silicon are metalloid. Tin and lead are metals.

6. **(c)** Due to structural changes, melting point, increases from Ga to Tl and Ga has the lowest melting point.

7. **(d)** Reluctance of valence shell electrons to participate in bonding is called inert pair effect. The stability of lower oxidation state (+2 for group 14 element) increases on going down the group. So the correct order is

$SiX_2 < GeX_2 < SnX_2 < PbX_2$

8. **(d)** The more the bond energy, the more is the catenation.

9. **(d)** Borax on heating gives B_2O_3 and $NaBO_2$ which is glassy mass and used for borax-bead test.

10. **(a)** $Al_2(SO_4)_3 + 6NH_4OH \rightarrow 2Al(OH)_3 + 3(NH_4)_2SO_4$

$Al(OH)_3 + NaOH \rightarrow Na^+[Al(OH)_4]^-$ Soluble complex

it is insoluble in NH_4OH

11. **(b)** The solution of aluminium chloride in water is acidic due to hydrolysis.

$$AlCl_3 + 3H_2O \longrightarrow Al(OH)_3 + 3HCl.$$

On heating it till dryness $Al(OH)_3$ is converted into Al_2O_3

$$2Al(OH)_3 \xrightarrow{\Delta} Al_2O_3 + 3H_2O$$

12. **(a)** Higher boranes are also spontaneously flammable in air.

13. **(a)** B_2O_3 is acidic and Al_2O_3 is amphoteric.

14. **(b)** Aluminium oxide is amphoteric oxide because it shows the properties of the both acidic and basic oxides. It reacts with both acids and bases to form salt and water.

$Al_2O_3 . xH_2O + 2NaOH \longrightarrow NaAlO_2 + H_2O$

$Al_2O_3 . xH_2O + HCl \longrightarrow AlCl_3 + H_2O$

15. **(c)** Fused alumina (Al_2O_3) is a bad conductor of electricity. Therefore, cryolite (Na_3AlF_6) and fluorspar (CaF_2) are added to purified alumina which not only make alumina a good conductor of electricity but also reduce the melting point of the mixture to around 1140 K.

16. **(c)** Due to +I effect of methyl groups the Lewis character of $B(CH_3)_3$ decreases and coordination becomes weaker.

17. **(b)** The hybridizations of B in H_3BO_3 is sp^2.

18. **(a)** Lead in +2 oxidation is stable while Sn and C are both stable in +4 oxidation.

19. **(b)** BCl_3 forms $[B(OH)_4]^-$ in which B is sp^3 hybridized and have +3 oxidation state.

20. **(d)**

21. **(a)**

22. **(b)** Silicon has $Si-O-Si-O-Si$ linkage.

23. **(c)** CO_2 being more dense covers the igniting material more effectively than N_2.

24. **(c)** Aluminium chloride in acidified aqueous solution forms octahedral $[Al(H_2O)_6]^{3+}$ ion.

25. **(d)** H_2CO_3/HCO_3^- buffer system help to maintain pH of blood between 7.26 to 7.42.

26. **(b)** Grey tin $\rightleftharpoons$ white tin

Grey tin is brittle and crumbles down to powder in very cold climate

The conversion of grey tin to white tin is acompained by increase in volume., This is knwon as tin plaque or tin discase.

27. **(c)** $SnCl_2 + 2NaOH \rightarrow Sn(OH)_2 + 2NaCl$

$Sn(OH)_2 + 2NaOH \rightarrow Na_2SnO_2 + 2H_2O$

28. **(a)** The stability of +2 O.S. follows the order

$Pb^{2+} > Sn^{2+} > Ge^{2+}$

Hence reducing power $Ge > Sn > Pb$

29. **(d)** $2CaF_2 + SiO_2 + H_2SO_4 \longrightarrow$

$$SiF_4 + H_2O + CaSO_4 \xrightarrow{\text{hydrolysis}} CaSiF_6$$

30. **(c)** Negative $\Delta_r G^\circ$ value indicates that + 2 oxidation state is more stable for Pb. Also it is supported by inert pair effect that + 2 oxidation state is more stable for Pb and as $\Delta_r G^\circ$ value is positive in second reaction it indicates that + 4 oxidation state is more stable for Sn.

i.e., $Sn^{2+} < Pb^{2+}$, $Sn^{4+} > Pb^{4+}$

31. **(a)** Metal atom in the lower oxidation state forms the ionic bond and in the higher oxidation state the covalent

bond because higher oxidation state means small size and great polarizing power and hence greater the covalent character. Hence MCl_2 is more ionic than MCl_4.

32. **(a)** H_3BO_3 is a weak monobasic acid.

33. **(d)** $Si_2O_7^{6-}$ ion represents pyrosilicate.

34. **(d)** It is mercury because it exists as liquid at room temperature.

35. **(b)** F and Cl are more oxidising in nature and can achieve Pb in (IV) O.S. but Br_2 and I_2 can not achieve Pb in (IV) O.S. secondly Pb^{4+} is strong in oxidising nature and in its presence, Br^- and I^- can not exist.

36. **(d)** Ge(II) tends to acquire Ge(IV) state by loss of electrons. Hence it is reducing in nature. Pb(IV) tends to acquire Pb(II) O.S. by gain of electrons. Hence it is oxidising in nature. This is due to inert pair effect.

37. **(d)** Hybridisation $=\frac{1}{2}(4+4+0-0)=4$, sp^3 tetrahedral.

38. **(b)** $8BF_3 + 6LiH \xrightarrow{\Delta} B_2H_6 + 6LiBF_4$

39. **(d)** In artificial respiration a mixture of O_2 with CO_2 or helium is used. Helium is used as it is less soluble in blood.

40. **(c)** Graphite is composed of flat two-dimensional sheets of carbon atoms. Each sheet is a hexagonal net of C atoms. The 3 e^- of C form σ bond & 4th electron is a π e^- and is delocalized over the whole sheet & is thus mobile. Conduction of electricity is due to these delocalized electrons within each layer. Conduction does not occur from one sheet to another.

41. **(c)** CO_2 forms carbonic acid H_2CO_3, when dissolved in water, CO is neutral, whereas other two GeO_2 and SnO_2 are solids.

42. **(d)** Carborundum is SiC.

43. **(b)** $R_3SiCl + HOH \rightarrow R_3SiOH + HCl$

$R_3SiOH + HOSiR_3 \rightarrow R_3Si-O-SiR_3 + H_2O$

44. **(a)** Carbon does not contain *d*-orbital hence it cannot expand its octet.

45. **(b)** Glass being a mixture of sodium and calcium silicates reacts with hydrofluoric acid forming sodium and calcium fluorosilicates respectively.

$Na_2SiO_3 + 6HF \rightarrow Na_2SiF_6 + 3H_2O$

$CaSiO_3 + 6HF \rightarrow CaSiF_6 + 3H_2O$

The etching of glass is based on these reactions.