

# CHEMISTRY

## BOOKS - V PUBLICATION

### THE p - BLOCK ELEMENTS

#### Question Bank

1. Discuss the pattern of variation of oxidation states of B to Tl



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2. Boron, Aluminium, Gallium, Indium and Thallium belong to group 13 of the periodic table of elements. How can you explain a higher stability of  $BCl_3$  as compared to  $TiCl_3$ ?



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3. Why does boron trifluoride behave as a Lewis acid?



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4. Consider the compounds,  $BCl_3$  and  $CCl_4$ .

How will they behave with water?



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5. Is boric acid a protonic acid ? Explain.



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6. Explain what happens when boric acid is heated?



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7. Explain the shapes of  $BF_3$  and  $BH_4^-$ .  
Assign hybridisation of Boron in these species.



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8. Write reactions to justify the amphoteric nature of Al.



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9. What are electron deficient compounds? Are  $BCl_3$  and  $SiCl_4$  electron deficient?



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10. Write down the resonance structures of  $CO_3^{2-}$  and  $HCO_3^-$



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11. What is the state of hybridisation of carbon in

(a) ' $CO_3^{2-}$ '

(b) diamond

(c) graphite?



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**12.** Explain the difference in properties of diamond and graphite on the basis of their structures



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**13.** Rationalise the statements and give chemical reactions. (i) Lead (II) Chloride reacts with  $Cl_2$  to give  $PbCl_4$



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14. Suggest a reason why B-F bond length in  $BF_3$  (130 pm) and  $BF_4^-$  (143 pm) differ?



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15. If 'B-Cl' bond has a dipole moment, explain why 'BCl<sub>3</sub>' molecule has zero dipole moment.



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16. Aluminium trifluoride is insoluble in anhydrous HF but dissolves on addition of NaF. Aluminium trifluoride precipitates out of the resulting solution when gaseous  $BF_3$  is bubbled through. Give reasons.



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17. Carbon monoxide is highly poisonous. Why?



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**18.** Two important oxides of carbon are carbon monoxide and carbon dioxide.

a) How is  $CO_2$  responsible for global warming?



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**19.** Borax, orthoboric acid and diborane are some useful compounds of boron. Explain the structure of diborane using a diagram.



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20. What happens when Borax is heated



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21. Explain the reaction Si is heated with methyl chloride at high temperature in presence of copper



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**22.** Give reasons (vii) Aluminium wire is used to make transmission cables.



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**23.** Explain why is there a phenomenal decrease in ionisation enthalpy from carbon to silicon?



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**24.** How do you explain the lower atomic radius of gallium as compared to aluminium?



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**25.** Carbon has many allotropes. Write the name of any two allotropic forms of carbon.



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**26.** Classify the oxides as neutral, acidic amphoteric and basic

*CO, B<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, PbO<sub>2</sub>, Tl<sub>2</sub>O<sub>3</sub>*



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**27.** In some of the reactions, thallium resembles aluminium, whereas in others it resembles with group 1 metals. Support this statement by giving some evidences



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**28.** When metal 'X' is treated with sodium hydroxide, a white precipitate (A) is obtained, which is soluble in excess of NaOH to give soluble complex (B). Compound (A) is soluble in dilute HCl to form compound (C). The compound (A) when heated strongly gives (D), which is used to extract metal. Identify ( 'X' ), (A), (B), (C) and (D). Write, suitable equations to support their identities.



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**29.** What do you understand by (a) Inert pair effect (b) allotropy (c) catenation.



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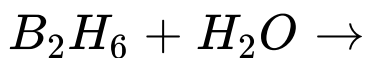
**30.** A certain salt X gives the following reactions (i) Its aqueous solution is alkaline to litmus



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31. Write balanced equation for



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32. Give one method for industrial preparation and one for laboratory preparation of 'CO'



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**33.** The aqueous solution of borax is

A. neutral

B. amphoteric

C. basic

D. acidic

**Answer: C**



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34. Boric acid is polymeric due to ----

A. Its acidic nature

B. The presence of hydrogen bonds

C. Its monobasic nature

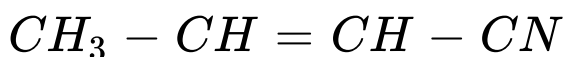
D. Its geometry.

**Answer: B**



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35. Write the type of hybridisation of each carbon in the compound



A. sp

B. 'sp<sup>2</sup>'

C. sp<sup>3</sup>'

D. dsp<sup>2</sup>'.

**Answer: C**



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**36.** Thermodynamically most stable allotrope of carbon is \_\_\_\_\_

A. Diamond

B. Graphite

C. Fullerenes

D. Coal

**Answer: B**



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37. The Elements of group 14 show ----  
oxidation states

A. exhibit oxidation state of '+4' only

B. exhibit oxidation state of '+2' and '+4'

C. form ' $M^{2+}$ ' and ' $M^{4+}$ ' ion

D. form ' $M^{2+}$ ' and ' $M^{4+}$ ' ions.

**Answer: B**



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**38.** If the starting material for the manufacture of silicones is 'RSiCl<sub>3</sub>', write the structure of the product formed.



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**39.** How is carbon monoxide important in metallurgy?



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**40.** What is the biological importance of  $H_2CO_3 / HCO_3^-$  equilibrium?



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**41.** Give reasons:

a. Silicon form compounds with coordination number of 5 and 6.



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**42.** Why does elemental silicon not form a graphite - like structure, whereas carbon does?



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**43.** Silanes get easily hydrolysed whereas alkanes do not. Give reasons.



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**44.** Diborane is an important hydride of Boron

a. During a class room discussion, a student argues that there is a covalent bond between boron atoms in diborane. What is your opinion. Give justification.

b. Boron halides can act as Lewis acids. Give reason.

c. Arrange the following Lewis acids in the increasing order of acidic strength. Substantiate your answer?

'BF<sub>3</sub> BCl<sub>3</sub>, BBr<sub>3</sub>'



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**45.** Carbon has several allotropic forms.

b. Prepare a short note on fullerenes.



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**46.** Why does not silicon form an analogue of graphite? OR Why does elemental silicon not form graphite like structure as carbon does? Explain.



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**47.** Why carbon forms covalent compounds whereas lead forms ionic compounds.



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**48.** Carbon exhibits catenation, whereas silicon does not. Explain.



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49.  $SiCl_4$  forms  $[SiCl_6]^{2-}$  while  $CCl_4$  does not form  $[CCl_6]^{2-}$ . Explain.



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50. when ' $CCl_4$ ' is mixed with ' $H_2O$ ', they become immiscible. Explain.



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51. The substance which can accept electrons is a Lewis acid. ' $\text{BCl}_3$ ,  $\text{BF}_3$ ' and ' $\text{BBr}_3$ ' are Lewis acids.

a. Arrange the above Lewis acids in the increasing order of their acid strength.

b. Give reason for this order of acidic strength,

c. The chemistry of boron is different from that of other members of the same group.

Mention any two differences and give reason.



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52.  $CO_2$  is a gas but  $SiO_2$  is a solid. Give reason.



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53. Briefly describe the structure of diborane.



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54. Starting from borax how will you prepare boric acid? (Write the chemical equation).



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**55.** Boron, Aluminium, Gallium, Indium and Thallium belong to group 13 of the periodic table of elements. How can you explain a higher stability of  $BCl_3$  as compared to  $TiCl_3$ ?



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**56.** Diborane is an important hydride of Boron  
a. During a class room discussion, a student



argues that there is a covalent bond between boron atoms in diborane. What is your opinion. Give justification.

b. Boron halides can act as Lewis acids. Give reason.

c. Arrange the following Lewis acids in the increasing order of acidic strength.

Substantiate your answer?

'BF<sub>3</sub> BCl<sub>3</sub>, BBr<sub>3</sub>'



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57. What is dry ice?



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58. Say TRUE or FALSE. Boron in aqueous solution forms  $B^{3+}$  ion.



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59. How does sodium hydride react with diborane?



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60. What is the maximum covalency of silicon in its compounds?



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61. Account for the following.

(i)  $PbX_2$  is more stable than

$PbX_4$  ( $X = Cl, Br$ )

(ii)  $PbCl_4$  is less stable than  $SnCl_4$  but  $PbCl_2$  is more stable than  $SnCl_2$



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62. 'C O<sub>2</sub>' can be represented by the structure 'O=C=O' comment.



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63. Diamond is hard and non conducting while graphite is soft and conducting. Why?



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**64.** Give reason for

(i) diamond is a covalent compound yet its melting point is very high

(ii) Diamond is used as a precious stone.



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**65.** Give a laboratory method to prepare diaborane and list some properties of

diborane.



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**66.** Why would high pressure be an expected condition for the transformation of graphite to a more dense diamond.



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**67.** What are fullerenes? How are they prepared?



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**68.** Gallium has higher ionisation enthalpy than aluminium. Explain why?



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**69.** Borax gets hydrolysed to give

A. basic medium

B. acidic medium

C. neutral medium

D. may be acidic or neutral

**Answer: A**



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**70.** Orthoboric acid on strong heating to red hot gives. metaboric acid borax boron tri oxide tetraboric acid

A. metaboric acid



B. borax

C. boron tri oxide

D. tetraboric acid

**Answer: A**



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**71.** The aqueous solution of borax is

A. bleaching agent

B. alkaline

C. acidic

D. neutral

**Answer: C**



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**72. Carborundum is**

A. Calcium carbide

B. boroncarbide

C. Aluminium carbide

D. silicon carbide

**Answer: D**



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**73.** The high temperature polymers of silicon are called silicates silicon halides . silanes silicones

A. silicates

B. silicon halides .

C. silanes

D. silicones

**Answer: D**



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**74.** Which of the following is not the form of silica? cassiterite, cristobalite, Tridymite, quartz

A. cassiterite

B. cristobalite

C. Tridymite

D. quartz

**Answer: A**



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**75.** The element having maximum abundance in earth's crust is

A. Si

B. N

C. O

D. Cl

**Answer: A**



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**76.** Hybridisation of boron in  $B_2H_6$  is ----

A. sp

B. sp<sup>2</sup>

C.  $sp^3$

D.  $dsp^2$

**Answer: C**



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77. Boric acid is polymeric due to ----

A. its acidic nature

B. the presence of hydrogen bonds

C. Its monomeric nature

D. its geometry

**Answer: B**



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**78.** The Elements of group 14 show ----  
oxidation states

A. exhibit oxidation state of '+4' only

B. exhibit oxidation state of '+2' and '+4'

C. form ' $M^{(2-)}$ ' and ' $M^{(+4)}$ ' ions



D. form ' $M^{(+2)}$ ' and ' $M^{(4-)}$ ' ions

**Answer: B**



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**79.** Boron is a : metal, non-metal, metalloid,  
alloy

A. metal

B. non-metal

C. metalloid

D. alloy

**Answer: B**



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**80.** Explain the action of heat on boric acid.

A. metaboric acid

B. tetraboric acid

C. boric oxide

D. pyroboric acid

**Answer: A**



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**81.** The compounds of boron with hydrogen are called : borides, boranes, diborane, orthoborate

A. borides

B. boranes

C. diborane

D. orthoborate

**Answer: B**



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**82.** Orthoboric acid on strong heating to red hot gives. metaboric acid borax boron tri oxide tetraboric acid

A. boron

B. boric oxide

C. pyroboric acid

D. raboric acid

**Answer: D**



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**83.** Glass is best described as a: solid, liquid, supercooled liquid, colloid

A. solid

B. liquid

C. supercooled liquid

D. colloid

**Answer: C**



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**84.** The aqueous solution of borax is

A. acidic

B. basic

C. neutral

D. may be acidic or neutral

**Answer: B**



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**85.** The allotropic form of carbon which is used for making lead of pencil is, (1) Lamp black (2) Charcoal (3) Graphite (4) Gas carbon

A. lamp black

B. charcoal

C. graphite

D. gas carbon

**Answer: C**



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86. The gas which combines with haemoglobin to damage its oxygen-carrying capacity is

A.  $\text{CO}_2(\text{g})$

B.  $\text{CO}(\text{g})$

C.  $\text{N}_2(\text{g})$

D.  $\text{O}_2(\text{g})$

**Answer: B**





87. The carbide which is used as abrasive is,

(1)WC (2)CaC<sub>2</sub> (3)Al<sub>4</sub> C<sub>3</sub> (4)SiC

A. WC

B. CaC<sub>2</sub>

C. Al<sub>4</sub> C<sub>3</sub>

D. SiC

**Answer: D**



**88.** Pyrosilicates are the silicates in which two tetrahedral units are linked at (a)one point (b)two points (c)three points (d)None

A. one point

B. two points

C. three points

D. None

**Answer: A**



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89. A  $\text{I}^{(3+)}$  is not isoelectronic with (1)Ne  
(2) $\text{Na}^+$  (3) $\text{F}^-$  (4) $\text{Ca}^{2+}$

A. Ne

B.  $\text{Na}^+$

C.  $\text{F}^-$

D.  $\text{Ca}^{(+2)}$

**Answer: D**



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90. Which one of the following elements has the highest melting point? (1) Boron (2) Aluminium (3) Gallium (4) Thallium

A. boron

B. aluminium

C. gallium

D. thallium

**Answer: B**



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91. Orthoboric acid,  $H_3BO_3$  is a

- A. Arrhenius acid
- B. Bronsted - Lewis acid
- C. Lewis acid
- D. all correct

**Answer: C**



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92. The hybridisation of boron in 'B F<sub>3</sub>' and 'BF<sub>4</sub>' respectively is sp<sup>2</sup>, sp<sup>3</sup> sp<sup>3</sup>, sp<sup>3</sup> s p<sup>3</sup>, s p<sup>3</sup> d'. sp<sup>2</sup>, sp<sup>2</sup>'

A. sp<sup>2</sup>, sp<sup>3</sup>'

B. sp<sup>3</sup>, sp<sup>3</sup>'

C. s p<sup>3</sup>, s p<sup>3</sup> d'.

D. sp<sup>2</sup>, sp<sup>2</sup>'

**Answer: A**



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93. Amorphous form of silica is : tridynite, cristobalite, fumed silica, asbestos

A. tridynite

B. cristobalite

C. fused silica

D. asbestos

**Answer: C**



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**94.** In silicon dioxide : each silicon atom is surrounded by four oxygen atoms and each oxygen atoms is bonded to two silicon atoms, silicon atom is bonded to two oxygen atoms , there are double bond between silica and oxygen atoms, silicon atom is bonded to five oxygen atoms

A. each silicon atom is surrounded by four oxygen atoms and each oxygen atoms is bonded to two silicon atoms.



B. silicon atom is bonded to two oxygen atoms

C. there are double between silica and oxygen atoms

D. silicon atom is bonded to five oxygen atoms

**Answer: A**



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95. Carborundum is

A. SiC'

B. AlCl<sub>3</sub>'

C. Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>'

D. Al<sub>2</sub>O<sub>3</sub> . 2 H<sub>2</sub>O'

**Answer: A**



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96. Which of the following statement about boric acid is false. : It acts as a monobasic acid , it is formed by the hydrolysis of boron halides , it has planar structure , It act as a tribasic acid

A. It acts as a monobasic acid

B. it is formed by the hydrolysis of boron halides

C. it has planes structure

D. It act as a tribasic acid

**Answer: D**



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**97.** Which of the following statement about boric acid is false. : It acts as a monobasic acid , it is formed by the hydrolysis of boron halides , it has planar structure , It act as a tribasic acid

**A.** It acts as a monobasic acid

B. it is formed by the hydrolysis of boron halides

C. it has planar structure

D. It acts as a tribasic acid

**Answer: D**



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**98.** Boron trioxide can be reduced with.....to get boron  
Carbon Hydrogen Magnesium  
Copper

A. Carbon

B. Hydrogen

C. Magnesium

D. Copper

**Answer: C**



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**99.** When boron burns in air it forms:

A.  $B_2O_3$

B.  $\text{BN}$

C.  $\text{H}_3\text{BO}_3$

D.  $\text{B}_2\text{O}_3$  &  $\text{BN}$

**Answer: D**



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**100.** Which compound among the following is an antiseptic?  $\text{BCl}_3$   $\text{H}_3\text{BO}_3$   $\text{BF}_3$   $\text{B}_2\text{O}_3$

A.  $\text{BCl}_3$

B.  $\text{H}_3\text{BO}_3$

C.  $\text{BF}_3$

D.  $\text{B}_2\text{O}_3$

**Answer: B**



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**101.** The boron compound which is formed when a solution of borax is acidified? Boric acid  
Boron nitride Boron trioxide Sodium meta borate



A. Boricacid

B. Boron nitride

C. Boron trioxide

D. Sodium meta borase

**Answer: A**



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**102.** Which of the following shows a tendency of dimerisation:?  
 $BCl_3$   $BF_3$   $BBr_3$   $BH_3$

A.  $\text{BCl}_3$

B.  $\text{BF}_3$

C.  $\text{BBr}_3$

D.  $\text{BH}_3$

**Answer: D**



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**103.** Which of the following is untrue regarding  $\text{BF}_3$  ? It is a Lewis acid , It is a

planar molecule, It has a dipole moment, It forms a compound with  $NH_3$

- A. It is a Lewis acid.
- B. It is a planar molecule
- C. It has a dipole moment
- D. It forms a compound with 'NH\_3'

**Answer: C**



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**104.** Hardest compound of boron is

- A. Boron nitride
- B. Boron carbide
- C. Boron silicide
- D. Magnesiumboride

**Answer: B**



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105. Which of the following is an acid anhydride.

A. CO'

B. CO<sub>2</sub>'

C. 'CaO'

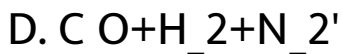
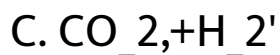
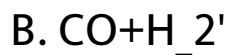
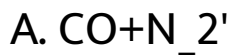
D. Al<sub>2</sub>O<sub>3</sub>'

**Answer: B**



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106. Producer gas is a mixture of



**Answer: A**



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**107.** Which is supposed to be the purest form of carbon? Fullerenes Charcoal Graphite Diamond

A. Fullerenes

B. Charcoal

C. Graphite

D. Diamond

**Answer: A**



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