

## **Subject: Chemistry**

### **Chapter – 11: P-Block Element**

#### **One mark questions**

1. What are p-block Elements?

p-block elements are those in which the lost electron enters the p orbital of the outermost shell.

2. Is an aqueous solution of borax is basic or acidic?

Basic.

3. What is the type of hybridization of boron in diborane?

$sp^3$ .

4. Which is the thermodynamically most stable form of carbon?

Graphite.

5. Why boric acid is polymeric?

Due to the presence of hydrogen bonds.

6. What happens when

a) Borax is heated strongly

loses water molecule to form sodium metaborate on further heating boric anhydride is formed.

b) Boric acid is added to water.

It accepts electrons from  $\text{OH}^-$  ion.

c) Aluminium is treated with dilute NaOH.

Sodium tetrahydroxoaluminate(III) and hydrogen gas is liberated.

d) Boron trifluoride is reacted with ammonia.

Form an adduct and results in complete octet around boron.

7. Classify the following oxides as neutral, acidic, basic or amphoteric.

$\text{CO}$ ,  $\text{B}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{CO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{PbO}_2$ ,  $\text{Ti}_2\text{O}_3$ .

Acidic- $\text{B}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{CO}_2$

Basic- $\text{Ti}_2\text{O}_3$

Neutral- $\text{CO}$

Amphoteric- $\text{Al}_2\text{O}_3$ ,  $\text{PbO}_2$ .

8. What are allotropes? Name the allotropes of carbon?

Elements having different physical properties and same chemical properties are known as Allotropes.

Allotropes of carbon – Graphite, Diamond, Fullerene .

9. Write the oxidation states exhibited by elements of group 14?

+2 and +4 .

10. What is the nature of hybridization in diamond and graphite?

$sp^3$  and  $sp^2$  respectively.

11. write the valence shell electronic configuration of p-block elements

$ns^2 np^{1-6}$  (except helium )

12. write the chemical composition of borax.

$Na_2 B_4 O_7 \cdot 10H_2O$

13. Which is the catalyst used to convert alcohols directly into gasoline?

ZSM-5

14. Which is the basic structural unit of silicates?

$SiO_4^{4-}$

15. Which is the repeating unit of organosilicon polymer?

$R_2SiO$

16. Name the important oxides of carbon?

$CO, CO_2$

17. Why carbon shows allotropic forms?

Due to property of catenation and  $P\pi - P\pi$  bond formation.

18. What happens atomic and ionic radii of p-block elements along a period?

Decreases.

19. What happens to ionization enthalpy of p-block elements of down a group?

Decreases.

20. Name the solid metalloid of p-block elements?

Boron.

21. Which is the most abundant metal in the earth crust?

Aluminium.

22. Which is the simplest boron hydride?

Di borane.

23. Which compound is known as inorganic benzene?

Borazine.

24. Who discovered fullerenes?

H.W.Kroto, E.Smalley and R.F.Curl.

25. What type of hybridization does carbon undergo in diamond?

$Sp^3$ .

26. What type of hybridization does carbon undergo in Graphite?

$Sp^2$ .

27. What is water gas ?

$CO+H_2$ .

28. What is producer gas?

$\text{CO} + \text{N}_2$ .

29. What is dry ice?

Solid  $\text{CO}_2$ .

30. What is the type of hybridization of boron in diborane?

$\text{Sp}^3$ .

31. Which gas is used in fizzy drinks and fire extinguisher?

$\text{CO}_2$ .

32. Why diamond donot conduct electricity?

Because it has no free electrons.

33. Name the allotropic form of carbon whose structure resembles soccer ball?

Fullerene,

34. Why  $\text{CH}_4$  is more stable than  $\text{SiH}_4$ ?

Due to small size of carbon.

35. Mention one use of dry ice?

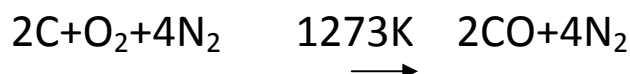
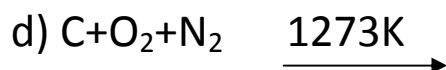
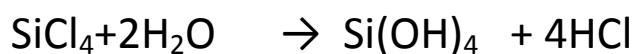
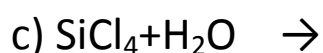
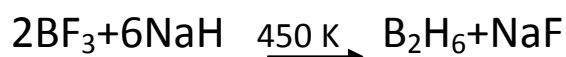
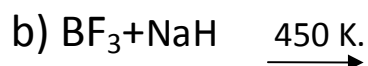
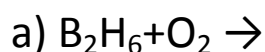
As a refrigerant for ice cream.

36. Write the equation for the decomposition of steam by tin?



## Two marks questions:-

37. Write balanced equations for



38. Diamond is covalent, yet it has high melting point. why?

Diamond has a three dimensional network involving strong c-c bonds, which are very difficult to break and in turn has high melting point.

39. Write the uses of boron.

In making bullet proof vest and light composite material for aircraft

40. Name the allotropes of carbon.

Diamond, graphite, fullerene.

41. Boron is unable to form  $\text{BF}_6^{3-}$  ion, explain.

Due to non-availability of d-orbitals boron is unable to expand its octet therefore, maximum covalence of boron exceed 4

42. Write the uses of the aluminium.

In making utensils, aeroplane and transportation industry etc.

43. Why Carbon monoxide is poisonous? Explain.

Because its ability to form a complex with haemoglobin. The CO-Hb complex is more stable than O<sub>2</sub>-Hb complex and prevents Hb to bind with oxygen, thus person dies due to lack of oxygen

44. Distinguish between diamond and graphite.

Diamond –each carbon atom is sp<sup>3</sup> hybridised and bonded to 4 other carbon atoms. C-C bond length is 154 pm

Graphite-each carbon atom is sp<sup>2</sup> hybridised and is bonded to 3 other carbon atoms. C-C bond length is 141.5 pm

45. Why does boron trifluoride behave as a lewis acid?

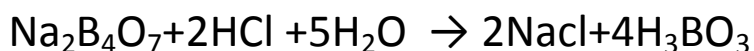
Octet remains incomplete hence electron deficient and acts as a lewis acid

46. What is the action of borax on heating?

It first loses water molecules to form sodium metaborate. On further heating forms glass like material known as borax bead

47. How is orthoboric acid is prepared from borax?

It can be prepared by acidifying an aqueous solution of borax



48. Why is boric acid considered as a weak acid?

Because it is not able to release  $H^+$  ions on its own. It receives  $OH^-$  ions from water molecule to complete its octet in turn releases  $H^+$  ions.

49. How to prepare diborane on industrial scale?

Boron trifluoride reacts with sodium hydride at 450K forms diborane.



50. Write the structure of diborane

Refer text book.

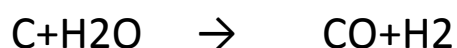
51. What is catenation?

Carbon atoms have the tendency to link with one another through covalent bonds to form chains and rings this property is called catenation.

52. Why boric acid is considered as a weak acid?

Boric acid is considered as a weak acid because it is not able to release  $H^+$  ions on its own. It receives  $OH^-$  ions from water molecules to complete its octet and in turn releases  $H^+$  ions.

53. Give one method for industrial preparation of CO.



54. Give one method for laboratory preparation of CO.





55. Explain why is there a phenomenal decrease in ionization enthalpy from carbon to silicon?

As carbon is very small in size its ionization energy is high . however on moving down the group the size of silicon increases and its ionization enthalpy decreases sharply.

56. How would explain the lower atomic radius of Ga as compared to Al?

Although Ga has one extra shell than Al , atomic radius is less than Al this is because the presence of additional 10d-electrons offer poor screening effect for the outer electrons in Ga , hence atomic radius of Ga is less than that of Al

57. Why carbon differs from rest of the members of its family.?

Due to its smaller size, higher electronegativity, higher ionization enthalpy and unavailability of d orbitals.

58. Diamond is covalent yet it has high melting point. Why.?

Diamond has a three – dimensional network involving strong C-C bonds, which are very difficult to break and in turn has high melting point.

59. Why graphite is used as a dry lubricant in machines running at high temperature.?

Graphite cleaves easily between the layers and therefore, it is very soft and slippery for this reason it is used as dry lubricant.

60. How to obtain carbon dioxide in laboratory?

By the action of dilute HCl on calcium carbonate.



61. Write the equation for the chemical change during photosynthesis?



62. Write the resonance structures of carbon dioxide?

Refer text book.

63. What are the crystalline forms of silica? Are they interconvertible?

Quartz, Cristobalite and tridymite. Yes

64. What are silicons.?

Group of organosilicon polymers, which have  $(\text{R}_2\text{SiO})$  as a repeating unit.

65. Name the important man made silicates.

Glass and cement

### **Three/four marks questions**

66. Discuss the pattern of variation in the oxidation states of

(1) B to Tl (2) C to Pb

(1) Due to small size of boron, the sum of its first 3 ionization enthalpies is very high, this prevents it to form +3 ions and

forces it to form only covalent compounds Al shows +3 oxidation state, on moving down the group, due to poor shielding effect of intervening d and f orbitals and inert pair effect, the two electrons present in the s-shell are strongly attracted by the nucleus and not participating in bonding. Hence +1 state becomes more stable down the group. In Ga, In and Tl, both +1 and +3 oxidation states are observed.

(2) the common oxidation state +4 and +2, down the group +2 oxidation state becomes common. C and Si show the +4 state. Down the group higher oxidation state is less stable because of inert pair effect.

67. Explain the structure of diborane.

The four terminal hydrogen atoms and the boron atoms lie in one plane. Above and below this plane, there are two bridging hydrogen atoms. The four terminal B-H bonds are regular two centre – two electron bonds while the two bridge (B-H-B) bonds are different and can be described in terms of three centre – two electron bonds as in the figure (refer text book).

68. Explain the anomalous behavior of carbon.

Due to its smaller size, higher electronegativity, higher ionization enthalpy and unavailability of d-orbitals only s and p orbitals are available for bonding so maximum covalence is 4 and due to catenation it shows allotropic forms.

69. How can you explain higher stability of  $\text{BCl}_3$  as compared to  $\text{TiCl}_3$ ?

Outer electronic configuration-  $ns^2np^1$ .

$BCl_3$  is more stable than  $TlCl_3$  because +3 oxidation state of B is more stable than +3 oxidation state of Tl, +3 state is highly oxidizing.

70. Explain the structure of diamond ?

It has a crystalline lattice.

Carbon atom undergoes  $sp^3$  hybridisation.

Linked to other 4 carbon atoms using hybridized orbitals in tetrahedral fashion.

C-C bond length is 154 pm.

Presence of covalent bonds.

71. Discuss the layered structure of graphite?

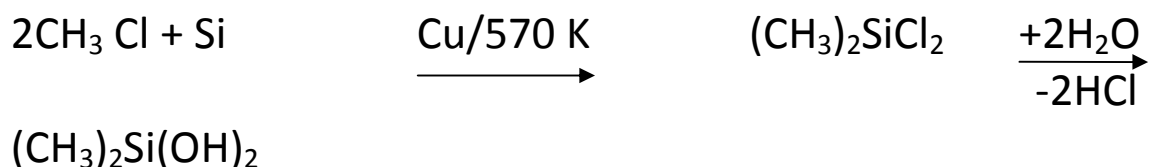
Vanderwaals forces between layers, distance between layers 340 pm, each layer is composed of planar hexagonal rings of carbon atoms, C-C bond length 141.5 pm- $sp^2$  hybridisation 3 sigma bonds and a pi bond.

72. Explain the structure of fullerenes?

These are cage like molecules contains 26 membered rings and 12 five membered rings. All carbon atoms are equal and undergoes  $sp^2$  hybridisation. Each carbon atom forms 3 sigma bonds with other 3 carbon atoms. The remaining electron at each carbon is delocalized in molecular orbitals. Both carbon – carbon single and double with distance 143.5 pm and 138.3 pm respectively.

73. How to synthesis organo silicon polymers?

Methyl chloride reacts with silicon in the presence of copper at 573 K methyl substituted chlorosilane are formed, hydrolysis of dimethyldichlorosilane followed by condensation polymerization yields organo silicon polymers.



74. A. Diamond is a bad conductor of electricity but graphite is good conductor, justify.

Due to  $\text{sp}^3$  hybridisation in diamond no free electron. In graphite due to  $\text{sp}^2$  hybridisation there free to conduct electricity.

B. Diamond is hardest substance while graphite is very soft, give reasons.

It is difficult to break extended covalent bonds in diamonds so it is hard. Graphite cleaves easily between the layers therefore it is very soft

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