



CHEMISTRY

BOOKS - NAGEEN CHEMISTRY (ENGLISH)

SOME P-BLOCK ELEMENTS

Review Exercises

1. Which of the following elements forms predominantly covalent compounds as

compared to other elements which form ionic compounds?



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2. In what respect does boric acid differ from other protonic acids ?



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3. Why does borax form a glassy mass on heating?



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4. What happens when a carboxylic acid is treated with lithium aluminum hydride ?



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5. What happens when orthoboric anhydride is heated with magnesium



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6. What happens when boron is heated in air?



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7. How would you prepare orthoboric acid from borax?



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8. How would you prepare diborane from boron trifluoride





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9. How would you prepare borax from colemanite



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10. How would you prepare orthoboric acid from borax?



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11. What is the hybrid state of carbon in ethyne, graphite and diamond ?



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12. What do you understand by allotropy ?
Name the allotropic forms of carbon.



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13. Explain, why diamond is very hard but graphite is soft .



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14. Why is carbon monoxide said to be a poisonous gas?



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15. Explain, why carbon dioxide turns lime water milky .



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16. Explain, why solid CO_2 is called dry ice?



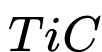
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17. To which category the following carbides belong ?



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18. To which category the following carbides belong ?



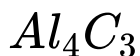
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19. To which category the following carbides belong ?



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20. To which category the following carbides belong ?



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21. To which category the following carbides belong ?



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22. To which category the following carbides belong ?



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23. What happens when steam is passed over red hot coke .



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24. What happens when ZnO is heated in a current of CO .



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25. What happens when iron is heated under pressure in an atmosphere of carbon monoxide .



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26. What happens when a burning strip of magnesium is introduced into a jar of CO_2



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27. What happens when carbon is treated with hot and conc. H_2SO_4



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28. What happens when carbon disulphide is treated with caustic soda?



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29. What are fullerenes ? Draw the structure of C_{60} .



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30. To which block of the periodic table do group 13 and group 14 elements belong? List all the elements of group 13 and 14 and write their electronic configuration.



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31. Which element of group 13 has highest electronegativity



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32. Which element of group 13 has the lowest boiling point



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33. Which element of group 13 forms covalent compounds only



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34. Which element of group 13 exhibits +1 oxidation state



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35. Which element of group 13 forms acidic oxide ?



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36. Explain, why does boron not form B^{3+} ions.



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37. Describe the following about Boron family (Group 13) elements :

Tendency of hydride formation



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38. Describe the following about Boron family

(Group 13) elements :

Stability of oxidation states



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39. Present a comparative account of the alkali and alkaline earth metals with respect to the following characteristics.

(a) Tendency to form ionic/covalent compounds (b) Nature of oxides and their

solubility in water

(c) Formation of oxosalts

(d) Solubility of oxosalts

(e) Thermal stability of oxosalts



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40. Describe the following about Boron family

(Group 13) elements :

Diagonal relationship of boron and silicon.



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41. Explain, why is boron trifluoride a strong Lewis acid.



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42. Account for the following:

Boron forms electron deficient compounds.



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43. What is inert-pair effect? Illustrate with an example.



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44. Arrange BF_3 , BCl_3 , BBr_3 , BI_3 in the decreasing order of Lewis acid character and explain.



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45. What is borazole and why is it also called 'inorganic benzene' ?



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46. Which one of the following elements does exhibit +1 oxidation state as well ?

Al, B, Ca, Tl, Be.



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47.

Arrange

$B\text{Cl}_3$, AlCl_3 , GaCl_3 , InCl_3 and TlCl_3 in the decreasing order of the stability of +3 oxidation state.



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



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49. $PbCl_4$ is less stable than $SnCl_4$, but $PbCl_2$ is more stable than $SnCl_2$. Give reasons.



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50. Explain, why CO_2 is a gas but SiO_2 is a solid.



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51. Explain, why silicon tetrachloride is hydrolysed but carbon tetrachloride is not.



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52. PbX_2 is more stable than PbX_4 (X = Cl, Br, I). Account for it.



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53. Explain, why is CO_2 a gas at room temperature but SiO_2 is a high melting solid.



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54. What is the general formula of silicones?



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55. What is the general name of synthetic polymers containing R_2SiO as repeating

units?



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56. Give a comparative account of the chemistry of carbon and silicon with regard to their property of catenation .



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57. Give a comparative account of the chemistry of carbon and silicon with regard to

their stability of hydrides and oxides.



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58. Explain giving reasons the following:

CCl_4 is not hydrolysed with water but $SiCl_4$ is easily hydrolysed.



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59. Explain giving reasons the following:

BF_3 is a weaker Lewis acid than BCl_3



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60. Account for the Silicon is an insulator but silicon doped with phosphorus acts as a semiconductor.



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61. What is meant by catenation? How does the catenation tendency for elements of group 14 vary?





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62. What is the hybrid state of carbon in ethyne, graphite and diamond ?



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63. What is the hybrid state of carbon in ethyne, graphite and diamond ?



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64. What is the hybridised state of carbon in



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65. Which of the following elements forms predominantly covalent compounds as compared to other elements which form ionic compounds?



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66. Account for the following:

C and Si show tetravalency in most of their compounds but Ge, Sn and Pb show bivalency.



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67. The first element in a group of p-block of the periodic table often displays different physical and chemical properties from the heavier members of the group. In the light of this statement give comparative explanations

for the following:

Nature of oxides of boron and aluminum



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68. The first element in a group of p-block of the periodic table often displays different physical and chemical properties from the heavier members of the group. In the light of this statement give comparative explanations for the following:

Action of water on CCl_4 and $SiCl_4$



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69. Explain, why is the +2 oxidation state of lead more stable than the +2 oxidation state of tin.



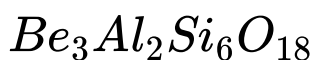
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70. Which element of group 16 has maximum tendency for catenation ?



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71. Write the structural difference of anions present in



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72. Write the structural difference of anions present in



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73. Give appropriate reason for the following:
Silicon has no allotropic form analogous to graphite.



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74. In the structure of diborane



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75. Account for the following:

Boron forms electron deficient compounds.



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76. Account for the following:

PbCl₄ is less stable than *SnCl₄*.



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77. Account for the following:

Sn(II) is a reducing agent but Pb(II) is not.



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78. Give chemical reactions in support of the following statement

The +1 oxidation state gets stabilised progressively from Ga to Tl in Group 13.



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79. Give chemical reactions in support of the following statement

Anhydrous $AlCl_3$ is used as a catalyst.



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80. Give reason for the following:

+1 gallium undergoes disproportionation reaction.



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81. Give reason for the following:

Zeolites act as shape selection catalysts.



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82. Name the chief ores of aluminium and zinc.



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83. How is that aluminium though an electropositive metal finds use as a structural material?



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84. Assign a reason for the following statement.

Unlike In^+ Tl^+ is stable with respect to disproportionation reactions.



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85. Account for the following observations

(a) AlCl_3 is a Lewis acid

(b) Though fluorine is more electronegative than chlorine yet BF_3 is a weaker Lewis acid than BCl_3

(c) PbO_2 is a stronger oxidising agent than SnO_2

(d) The +1 oxidation state of thallium is more stable than its +3 state.



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86. Draw the structures of





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Very Short Answer Type Questions

1. Name the groups whose elements belong to the p-block of the periodic table.



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2. How does boron occur in nature and how is it prepared ? Describe its important chemical properties and uses.



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3. Write the formulae of borax and boric acid.



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4. Name any three minerals of boron.



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5. Is boron a good conductor of electricity ?



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6. What is the formula of diborane ?



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7. What is inorganic benzene and how is it obtained?



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8. How many 3c-2e bonds are present in diborane ?



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9. What are H_bBH_b and H_tBH_t angles in diborane ?



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10. Do boron halides exist as dimeric species?



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11. Write the state of hybridisation of boron in BF_3 .



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12. Arrange BF_3 , BCl_3 , BBr_3 , BI_3 in the decreasing order of Lewis acid character and explain.



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13. What type of bond is responsible for the partial compensation of the electron deficiency of a boron halide ?



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14. Name the mineral which is the crude form of borax.



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15. What is borax glass?



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16. What is the nature of an aqueous solution of borax ?



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17. What is the colour of the flame obtained on burning the vapours of ethyl borate?



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18. Why is boric acid used in glass industry?



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19. What is the basicity of orthoboric acid ?



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20. What type of compounds are usually formed by boron?



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21. What type of cations are tested by borax bead test?



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22. Diamond And Graphite



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23. Among diamond and graphite, which is a good conductor of electricity ?



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24. Name a chemical which affects diamond.



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25. For what purpose are the black diamonds used ?



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26. What is the composition of the compound formed by the reaction of carbon with fluorine ?



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27. Thermodynamically the most stable form of carbon is

(a) diamond , (b) graphite

(c) fullerenes , (d) coal



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28. What is carborundum ?



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29. Which gases are evolved when carbon is treated with conc. HNO_3 ?



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30. Explain the reducing action of carbon mono oxide.



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31. Which gas is evolved when formic acid is heated with conc. H_2SO_4 ?



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32. Which compound of carbon is a treacherous poison ?



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33. Can magnesium burn in an atmosphere of CO_2 ?



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34. What is the nature of an aqueous solution of CO_2 ?



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35. Which gas is obtained when CO_2 is passed over red hot coke ?



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36. Give the color and odour of commercial sample of carbon disulphide.



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37. Which has a larger atomic radius : Al or Ga?



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38. Arrange the elements of group 13 in the increasing order of electropositive character.



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39. How does the stability of +1 and +3 oxidation states vary in group 13?



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40. Does boron form ionic compounds ?



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41. What is the common name of hydrides of boron?



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42. Name the bonding which links the two boron atoms in a diborane molecule.



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43. What is the molecular formula of aluminium chloride ?



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44. Write the general valence shell electronic configuration of group 13 elements.



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45. Write the general valence shell electronic configuration of group 14 elements.



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46. Among groups 1 and 2, the elements of which group have higher ionisation enthalpies ?



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47. Among the elements of group 14, which element shows the highest tendency for catenation?



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48. What are the common oxidation states exhibited by the elements of group 14 and which state is more stable for Pb ?



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49. What type of multiple bonds are involved in the compounds containing $C \equiv C$, $C \equiv O$ and $-C \equiv N$ groups ?



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50. Among the tetrachlorides of group 14 elements, which one does not undergo hydrolysis?



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51. What is the shape of a CO_2 molecule ?



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52. What is the structural unit present in silicates ?



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53. Write the empirical formula of a silicone.



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Short Answer Type Questions

1. What are the important minerals of boron ?



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2. Account for the following:

Boron forms electron deficient compounds.



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3. Discuss the structure of diborane.



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4. How would you prepare borax from colemanite



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5. Which of the following compound is formed in borax bead test?



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6. Explain structures of diborane and boric acid.



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7. Why do boron halides form addition compounds with ammonia ?



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8. What happens when boron trichloride is heated with dihydrogen at 1270 K.



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9. What happens when boron is treated with caustic alkalis .



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10. What happens when diborane is dissolved in water.



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11. What happens when vapour obtained on heating a mixture of boric acid and ethyl alcohol is burnt.



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12. Explain what happens when boric acid is heated .



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13. Why do boron halides act as Lewis acids ?



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14. How is diborane prepared ?



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15. What is inorganic benzene and how is it obtained?



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16. Why do boron halides exist as monomeric species?



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17. Explain giving reasons the following:

BF_3 is a weaker Lewis acid than BCl_3



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18. Why does the Lewis acid strength of boron halides follow the order

$BBr_3 > BCl_3 > BF_3$?



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19. Why is an aqueous solution of borax slightly alkaline ?



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20. Why does borax swell up on heating?



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21. How would you prepare borax from colemanite



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22. How does carbon occur in nature ?



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23. Name three crystalline allotropes of carbon.



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24. What is the hybrid state of carbon in ethyne, graphite and diamond ?



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25. which of the following is not true about structure of diamond and graphite?



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26. Why is diamond resistant to most of the reagents ?



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27. Graphite is anisotropic with respect to conduction of electric current. Explain.



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28. Explain why graphite is soft and can be used as a lubricant.



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29. Explain, why diamond is very hard but graphite is soft .



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30. How will you account for the following:

Graphite is soft and is used as a solid lubricant.



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31. Write a short note on the amorphous forms of carbon.



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32. What happens when carbon is treated with hot and conc. H_2SO_4



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33. Give a brief account of the reducing properties of carbon.



Watch Video Solution

34. Why is carbon monoxide regarded as a treacherous poison ?



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35. What happens when steam is passed over red hot coke .



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36. What happens when sodium formate is heated with conc. H_2SO_4



Watch Video Solution

37. What happens when carbon monoxide is passed over nickel heated to 325-345 K



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38. What happens when carbon dioxide is passed through lime water?



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39. What is the role of CO_2 in the synthesis of carbohydrates in plants?



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40. Why are boron halides and diborane referred to as 'electron deficient compounds' ?



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41. What happens when a borax solution is acidified ? Write a balanced equation for the reaction.



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42. Why do boron halides form addition compounds with ammonia ?



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43. With the help of a balanced chemical equation, show that $B(OH)_3$ behaves as an acid in water.



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44. Write the resonance structures of CO_3^{2-} and HCO_3^- .



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45. What is dry ice and why is it called so ?



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46. Write the names and electronic configuration of all the elements belonging to

group 13.



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47. Why is the atomic radius of gallium smaller than that of aluminium?



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48. How do the Density property vary on moving down the group 13?



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49. How do the Melting and boiling points property vary on moving down the group 13?



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50. How do the Metallic character property vary on moving down the group 13?



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51. Why are the second and third ionisation energies of group 13 elements much higher as compared to their first ionisation energies?



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52. What is inert-pair effect? Illustrate with an example.



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53. Why does the stability of + 3 oxidation state decrease on moving down the group 13 ?



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54. Atomic size increases down a group of the periodic table. Explain.



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55. Why does gallium have higher ionisation energy than aluminium?



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56. Boron does not form ionic compounds containing B^{2+} ions. Comment on the statement with suitable explanation.



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57. In the structure of diborane,



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58. Why do boron halides act as Lewis acids ?



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59. Arrange BF_3 , BCl_3 , BBr_3 , BI_3 in the decreasing order of Lewis acid character and explain.



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60. Why is boron trifluoride a weaker Lewis acid as compared to BBr_3 and BCl_3 ?



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61. Discuss the structure of aluminium chloride.



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62. In spite of being electron deficient, boron halides do not exist as dimers. Explain.



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63. What type of oxides are formed by group 13 elements and how does their acidic character vary on moving down the group ?



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64. Why does boron differ from other elements of its own group in several properties?



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65. Boron does not form $[BF_6]^{3-}$, whereas aluminium forms $[AlF_6]^{3-}$. Explain.



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66. Mention any four properties which show that boron shows diagonal relationship with silicon.



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67. Why are the melting and boiling points of C and Si much higher as compared to those of other elements of the group ?



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68. The ionisation energy decreases on moving down the group 14. Explain



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69. The first ionisation energy of carbon is much higher than that of silicon . Explain.



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70. Why is the ionisation energy of lead slightly higher than that of tin?



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71. The electronegativity remains almost constant in going from Si to Pb. Explain.



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



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73. What do you understand by catenation ?
How does the property vary in group 14?



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74. What are the common oxidation states exhibited by the elements of group 14 ? Comment on their stability on moving down the group.



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75. Why does lead prefer to exist in +2 oxidation state instead of +4 although it possesses four electrons in its valence shell ?



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76. The tetrahalides of carbon do not form complexes, whereas the tetrahalides of the other elements of group 14 do so. Comment on the statement and explain.



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77. Explain giving reasons the following:

CCl_4 is not hydrolysed with water but $SiCl_4$ is easily hydrolysed.



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78. Explain, why CO_2 is a gas but SiO_2 is a solid.



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79. What are silicones and what are their important properties?



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Essay Long Answer Type Question

1. How does boron occur in nature and how is it prepared ? Describe its important chemical properties and uses.



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2. What are boranes? Describe the preparation, properties and uses of diborane.



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3. In the structure of diborane



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4. Discuss the structure of the halides of boron and describe their important characteristics.



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5. How is borax prepared from boron minerals? Describe its important properties and uses. What is borax bead test?



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6. How would you prepare boric acid from borax and from colemanite? Discuss its structure.



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7. What do you understand by allotropy ?

Name the allotropic forms of carbon.



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8. Discuss the structures of diamond and graphite and explain the hardness and electrical conductivity of these allotropes on the basis of structures.



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9. How does carbon occur in nature? Describe its important physical and chemical properties.



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10. How is carbon monoxide prepared ? How does it react with metallic oxides, dihydrogen and chlorine ?



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11. How would you prepare carbon dioxide in the laboratory? Describe its acidic nature and the action on lime water. What is photosynthesis ?



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12. Write the structure of diborane and explain the nature of bonding in it.



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13. Describe briefly how elemental boron can be prepared.



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14. The shapes and hybridisation of BF_3 and BH_4^- respectively are



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



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16. What are fullerenes and how are they prepared ?



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17. Discuss the properties of group 13 elements with reference to ionisation energy



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18. Discuss the properties of group 13 elements with reference to oxidation states



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19. Discuss the properties of group 13 elements with reference to Lewis acid character of trihalides.



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20. Discuss the properties of group 13 elements with reference to nature of oxides.



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21. What are boranes? How is diborane prepared from boron halides? Discuss its structure.



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22. Why does boron differ from other elements of its own group in several properties?



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23. Highlight the difference in the structures of boron trichloride and anhydrous aluminium trichloride.



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24. What is inert-pair effect? Illustrate with an example.



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25. In what ways does boron show similarities to silicon which is diagonally opposite to it in the periodic table ?



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26. Discuss the important characteristics of group 14 elements with a special reference to the following property:

Allotropy



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27. Discuss the important characteristics of group 14 elements with a special reference to the following property:

Catenation



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28. Discuss the important characteristics of group 14 elements with a special reference to the following property:

Oxidation states



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29. Discuss the important characteristics of group 14 elements with a special reference to the following property:

Multiple bond formation.



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30. Give a brief account of the allotropy exhibited by group 16 elements.



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31. Illustrate inert pair-effect with reference to the chemistry of group 14 elements.



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32. Discuss the important characteristics of the following compounds of group 14 elements:

Hydrides



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33. Discuss the important characteristics of the following compounds of group 14 elements:

Halides



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34. Discuss the important characteristics of the following compounds of group 14

elements:

Oxides



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35. What are silicones ?



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36. Why does boron differ from other elements of its own group in several properties?



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Objective Multiple Choice Type Questions

1. Melting point is highest for

A. B

B. Al

C. Ga

D. In

Answer: A



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2. Which of the following statements is not correct for BF_3 ?

- A. It can form adduct
- B. It acts as a Lewis base
- C. It forms an ionic bond

D. It also forms dative bonds with compounds like NH_3 , etc.

Answer: B



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3. Boric acid is polymeric due to

(a) its acidic nature , (b) the presence of hydrogen bonds

(c) its monobasic nature , (d) its geometry

A. its acidic nature

B. the presence of hydrogen bonds

C. its monobasic nature

D. its geometry.

Answer: B



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4. Which of the following is a false statement about boric acid, H_3BO_3 ?

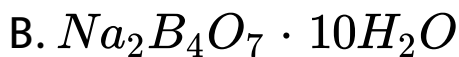
- A. It is a strong tribasic acid.
- B. It does not act as proton donor but acts as a Lewis acid by accepting hydroxyl ion.
- C. It is prepared by acidifying an aqueous solution of boric acid.
- D. It has a layer structure in which planar BO_3 units are joined by hydrogen bonds.

Answer: A



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5. Write the formulae of borax and boric acid.



Answer: B



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6. In diborane, banana bond is formed between

A. 2 electrons, 3 atoms

B. 2 electrons, 1 atom

C. 2 electrons, 2 atoms

D. 1 electron, 2 atoms.

Answer: A



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7. Boron is a

A. metal

B. non-metal

C. semi-metal

D. metalloid

Answer: C



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8. Boron trihalides act as Lewis acids. Their Lewis acid strength is in the order



Answer: C



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9. The weakest Lewis acid strength of BF_3 among boron halides can be explained on the basis of

A. the most electronegative nature of F

B. $P\pi - P\pi$ back bonding

C. $d\pi - p\pi$ back bonding

D. bond energy of B - F bond.

Answer: B



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10. In spite of being electron deficient, boron halides do not exist as dimers. Explain.

- A. small size of boron atom
- B. high electronegativity of boron
- C. the absence of d-orbitals in boron
- D. inert-pair effect.

Answer: A



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11. Which is true for an element present in group 13 of the periodic table?

A. It is a gas at room temperature.

B. It has oxidation state of +4.

C. It forms R_2O_3 .

D. It forms RX_2 .

Answer: C



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12. Al and Ga have nearly the same covalent radii because of

A. greater shielding effect of s-electrons of Ga atoms

B. poor shielding effect of s-electrons of Ga atoms

C. poor shielding effect of d-electrons of Ga atoms

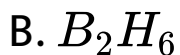
D. greater shielding effect of d-electrons of Ga atoms.

Answer: C



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13. Three centred bond is present in

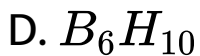
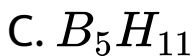
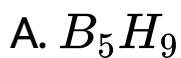


Answer: B



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14. Which one is not a borane ?



Answer: B



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15. Why do boron halides act as Lewis acids ?

A. acidic nature

B. covalent nature

C. ionisation property

D. electron deficient nature

Answer: D



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16. Group 13 elements show

A. only +3 oxidation state

B. only +1 oxidation state

C. both +1 and +3 oxidation states

D. -3 oxidation state.

Answer: C



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17. Why does the Lewis acid strength of boron halides follow the order



Answer: B



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18. Which of the following does not form M^{+3} ?

A. A)B

B. B)Al

C. C)Ga

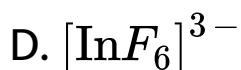
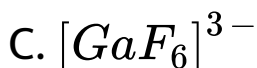
D. D)In

Answer: A



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19. Which of the following species does not exist?



Answer: A



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20. The stability of +1 oxidation state in aqueous solution is in the order-

$Al < Ga > In > Tl$

$Tl > In > Ga > Al$

$Al > Tl > Ga > In$

$Tl > Al > Ga > In$

A. $Al < Ga > In > Tl$

B. $Tl > In > Ga > Al$

C. $Al > Tl > Ga > In$

D. $Tl > Al > Ga > In$

Answer: A



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21. Which of the following is a non-metal ?

A. Gallium

B. Indium

C. Boron

D. Aluminium

Answer: C



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22. Which metal is protected by a layer of its own oxide?

A. Al

B. Ag

C. Au

D. Fe

Answer: A



23. Aluminium (III) chloride forms a dimer because aluminium

- A. cannot form a trimer
- B. has high ionisation energy
- C. belongs to third group
- D. can have higher coordination number.

Answer: D



24. In which of the following the inert pair effect is most prominent?

A. C

B. Si

C. Ge

D. Pb

Answer: D



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25. $d_{\pi} - p_{\pi}$ bonding exists in

- A. diamond
- B. graphite
- C. trisilylamine
- D. none of these

Answer: C



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26. The tendency to form $p_{\pi} - p_{\pi}$ multiple bonds in group 14 is most prominent for

A. C

B. Si

C. Sn

D. Pb

Answer: A



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27. Which of the following is not correct?

A. $Ge(OH)_2$ is amphoteric

B. $GeCl_2$ is more stable than $GeCl_4$

C. GeO_2 is weakly acidic

D. $GeCl_4$ in HCl forms $[GeCl_6]^{2-}$ ion

Answer: B



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28. In group 14 of the periodic table, the oxidising power of tetravalent species decreases in the order



D. $Pb > Sn > Ge$

Answer: D



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29. Which of the following halides is least stable and has doubtful existence ?

A. CCl_4

B. SnI_4

C. GeI_4

D. Pb_4

Answer: D



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30. Which one of the oxides is neutral?

A. CO

B. SnO_4

C. ZnO

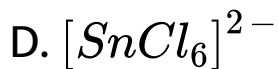
D. SiO_2

Answer: A



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31. Which does not exist ?



Answer: A



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32. Which of the following is a semiconductor?

A. C

B. Pb

C. Ge

D. Sn

Answer: C



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33. Graphite is a good conductor of electricity because it contains

- A. bonded electrons
- B. mobile electrons
- C. strong C-C bonds
- D. strong C=C bonds.

Answer: B



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34. Element showing the phenomenon of allotropy is

A. aluminium

B. tin

C. lead

D. copper

Answer: B



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35. It is because of inability of ns^2 electrons of the valence shell to participate in bonding that

A. Sn^{2+} is reducing while Pb^{4+} is oxidising

B. Sn^{2+} is oxidising while Pb^{4+} is reducing

C. Sn^{2+} and Pb^{2+} are both oxidising and reducing

D. Sn^{4+} is reducing while Pb^{4+} is oxidising

Answer: A



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36. Which one of the following elements is unable to form MF_6^{2-} ion?

A. Ga

B. Al

C. B

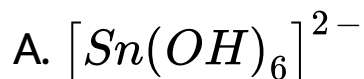
D. In

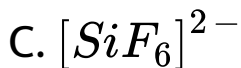
Answer: C



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37. Which of the following species is not stable?





Answer: B



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38. Which of the following is incorrect statement?

A. GeX_4 ($X = F, Cl, Br, I$) is more stable than GeX_2

B. SnF_4 is ionic in nature

C. PbF_4 is covalent in nature

D. SiCl_4 is easily hydrolysed

Answer: C



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39. The C—C bond length is maximum in :

(a) C_{60}

(b) diamond

(c) C_{70}

(d) All of these

A. C_{60}

B. diamond

C. C_{70}

D. All of these

Answer: B



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40. In comparison to boron, beryllium has :

A. (A) lesser nuclear charge and greater first ionisation enthalpy

B. (B) greater nuclear charge and greater first ionisation enthalpy

C. (C) greater nuclear charge and lesser first ionisation enthalpy

D. (D) lesser nuclear charge and lesser first ionisation enthalpy.

Answer: A



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41. The correct statements among I to III regarding group 13 element for oxides are:

(I) Boron trioxide is acidic

(II) Oxides of aluminium and gallium are amphoteric.

(III) Oxides of indium and thallium are basic.

A. (I) and (II) only .

B. (I) and (III) only

C. (II) and (III) only

D. (I), (II) and (III) only

Answer: D



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42. The amorphous form of silica is

A. kieselguhr

B. tridymite

C. cristobalite

D. quartz

Answer: A



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43. C_{60} an allotrope of carbon contains

A. 16 hexagons and 16 pentagons

B. 12 hexagons and 20 pentagons

C. 18 hexagons and 14 pentagons

D. 20 hexagons and 12 pentagons.

Answer: D



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44. Diborane (B_2H_6) reacts independently with O_2 and H_2O to produce, respectively:

A. H_3BO_3 and B_2O_3

B. B_2O_3 and H_3BO_3

C. B_2O_3 and $[BH_4]^-$

D. HBO_2 and H_3BO_3

Answer: B



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True Or False Type Question

1. Boron belongs to group 13 of the periodic table. True/False.



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2. Boric acid is used as an antiseptic



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3. At high temperature , boron burns in air to give a mixture of B_2O_3 and BN.



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4. Boron is used in glass industry for making specific type of glass.



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5. BH_3 is a stable hydride. True/False



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6. Borax glass is a specific type of glass.



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7. Comment over the following statement

Boric acid (H_3BO_3) is a tribasic acid.



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8. The atomic radii of group 13 elements are larger than those of group 2 elements.

True/False.



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9. The elements of group 13 are more electronegative than those of groups 1 and 2. True/False



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10. Diborane is an electron-deficient compound.



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11. $AlCl_3$ is a Lewis acid.



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12. The Lewis acid strength of BF_3 is less than that of BCl_3 Why?



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13. Being electron deficient, boron halides exist as dimers. True/False.



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14. Comment over the following statement

Ga_2O_3 is an amphoteric oxide.



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15. Comment over the following statement

The electronegativity of Pb is higher than that of Sn.



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16. Due to inert pair effect, the stability of +2 oxidation state increases on moving down the group 14. Why?



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17. Silicon tetrachloride undergoes hydrolysis to form silicic acid.



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18. CO is an acidic oxide.



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19. The viscosity of silicone oils is not affected much by a variation in temperature.



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Fill In The Blanks Type Questions

1. Trihalides of boron are compounds and act as Lewis



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2. In borax bead test, copper forms a coloured bead in oxidising flame and a coloured bead in reducing flame.



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3. In diborane, the two boron atoms are linked together by two bonds.



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4. Orthoboric acid is a basic acid.



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5. The purest and the densest variety of carbon is



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6. Graphite is used as a in atomic reactors.



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7. The densities of group 13 elements are
than those of group 2 elements.



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8. The elements of group 13 are
electronegative than those of groups 1 and 2.



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9. The reluctance of valence shell s-electrons
pair to get unpaired and to participate in
bond formation is called



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10. Fill in the blanks

The compounds of Al are predominantly
due to the size and charge of
 Al^{3+} ions.



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11. The main product obtained on reducing
boron trichloride with lithium aluminium
hydride is



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12. In diborane, the two boron atoms are linked together by two bonds.



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13. BF_3 has a structure.



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14. $B(OH)_3$ is in nature.





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15. Boron shows diagonal relationship with



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16. The electronic configurations of group 14 elements are of the type



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17. The ability of an element to form long chains or rings by linking its atoms is called

.....



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18. Due to inert pair effect, the stability of +2 oxidation state increases on moving down the group 14. Why?



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19. Trimethylamine molecule is in shape, while the shape of trisilylamine is



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20. The compound having the highest bond energy among diatomic molecules is



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21. SnO_2 is..... in nature



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22. Silicones are also referred to as
polymers because they have very high



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Assertion Reason Type Questions

1. Assertion : When CO_2 is continuously bubbled through lime water, a precipitation is

formed which later dissolves

Reason : Calcium carbonate is initially formed which reacts further with CO_2 to form calcium bicarbonate.

A. If both Assertion and Reason are correct and Reason is the Correct explanation of the Assertion.

B. If both Assertion and Reason are Correct but Reason is not the Correct explanation of the Assertion.

C. If Assertion is Correct but Reason is
Incorrect

D. If Assertion is incorrect but Reason is
Correct

Answer: A



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2. Assertion : Among $SiCl_4$ and CCl_4 only
 $SiCl_4$ reacts with water.

Reason : $SiCl_4$ is ionic and CCl_4 is covalent .

A. If both Assertion and Reason are correct and Reason is the Correct explanation of the Assertion.

B. If both Assertion and Reason are Correct but Reason is not the Correct explanation of the Assertion.

C. If Assertion is Correct but Reason is Incorrect

D. If Assertion is incorrect but Reason is Correct

Answer: C



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Ncert Textbook Exercises With Hints And Solutions

1. Discuss the pattern of variation in the oxidation states of (i) B to Tl and (ii) C to Pb.



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2. Explain, why is the +2 oxidation state of lead more stable than the +2 oxidation state of tin.



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3. How can you explain higher stability of BCl_3 as compared to $TlCl_3$?



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



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5. Consider the compounds, BCl_3 and CCl_4 .
How will they behave with water ? Justify.



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6. Is boric acid a protic acid ? Explain.



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7. Explain what happens when boric acid is heated .



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8. Describe the shapes of BF_3 and BH_4^- .

Assign the hybridisation of boron in these species.



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9. Write reactions to justify amphoteric nature of aluminium.



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10. What are electron deficient compounds ?
Are BCl_3 and $SiCl_4$ electron deficient species ? Explain.



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11. Write the resonance structures of CO_3^{2-} and HCO_3^- .



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12. What is the state of hybridisation of carbon in (a) CO_3^{2-} (b) diamond (c) graphite?



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13. What is the state of hybridisation of carbon in (a) CO_3^{2-} (b) diamond (c) graphite?



[Watch Video Solution](#)

14. What is the state of hybridisation of carbon in (a) CO_3^{2-} (b) diamond (c) graphite?



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



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16. Rationalise the given statements and give chemical reactions : • Lead(II) chloride reacts with Cl_2 to give $PbCl_4$. • Lead(IV) chloride is highly unstable towards heat. • Lead is known not to form an iodide, PbI_4 .



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19. Suggest reasons why the B–F bond lengths in BF_3 (130 pm) and BF_4^- (143 pm) differ.



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20. If B–Cl bond has a dipole moment, explain why BCl_3 molecule has zero dipole moment.



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21. 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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22. Suggest a reason as to why CO is poisonous.



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23. How is excessive content of CO_2 responsible for global warming ?



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24. Explain structures of diborane and boric acid.



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25. What happens when Borax is heated strongly.



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26. What happens when Boric acid is added to water



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27. What happens when Aluminium is treated with dilute NaOH .



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28. What happens when BF_3 is reacted with ammonia?



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29. Explain the following reactions

(a) Silicon is heated with methyl chloride at high temperature in the presence of copper,

(b) Silicon dioxide is treated with hydrogen fluoride,

(c) CO is heated with ZnO,

(d) Hydrated alumina is treated with aqueous NaOH solution.



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30. Explain the phenomena of itching of glass



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31. Explain the following reaction :

CO is heated with ZnO



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32. Explain the following reactions

(a) Silicon is heated with methyl chloride at

high temperature in the presence of copper,

(b) Silicon dioxide is treated with hydrogen fluoride,

(c) CO is heated with ZnO,

(d) Hydrated alumina is treated with aqueous NaOH solution.



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33. Explain why :

Conc. nitric acid can be stored in aluminium containers.



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34. Give reasons

A mixture of dilute NaOH and aluminium pieces is used to open drain.



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35. Give reasons

Graphite is used as lubricant.



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36. Give reasons

Diamond is used as an abrasive.



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37. Give reasons

Aluminium alloys are used to make aircraft body.



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38. Give reasons

Aluminium utensils should not be kept in water overnight.



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39. Give reasons for the following: Aluminium is used in transmission wires.



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



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41. The reason behind the lower atomic radius of Ga as compared to Al is



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42. What are allotropes? Sketch the structure of two allotropes of carbon namely diamond and graphite.



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43. Classify following oxides as neutral, acidic, basic or amphoteric:

CO, B₂O₃, SiO₂, CO₂, Al₂O₃, PbO₂, Tl₂O₃



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44. Write suitable chemical equations to show the nature of Calcium oxide and carbon dioxide



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



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46. 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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47. What do you understand by (a) inert pair effect (b) allotropy and (c) catenation?



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48. What do you understand by allotropy ?
Name the allotropic forms of carbon.



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49. What do you understand by catenation.



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50. A certain salt (X) gives the following tests

:

(a) Its aqueous solution is alkaline to litmus.

(b) On strong heating, it swells up to give a glassy material (Y).

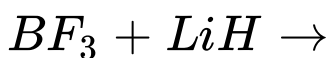
(c) When conc. H_2SO_4 is added to a hot concentrated solution of (X), white crystal of a weak acid (Z) separates out.

Identify (X), (Y) and (Z) and write down the chemical equations for reaction at steps a , b and c .



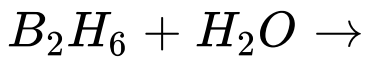
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51. Write balanced equation for



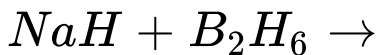
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52. Write balanced equation for



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53. Write balanced equation for



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54. Write balanced equation for $H_3BO_3 \xrightarrow{\Delta}$



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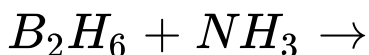
55. Complete and balanced the equations:





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56. Write balanced equation for



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57. Give one method for industrial preparation and one for laboratory preparation of CO and CO_2 each.



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58. An aqueous solution of borax is

A. A. Neutral

B. B. Amphoteric

C. C. Basic

D. D. Acidic

Answer: C



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59. Boric acid is polymeric due to

(a) its acidic nature , (b) the presence of hydrogen bonds

(c) its monobasic nature , (d) its geometry

A. its acidic nature

B. the presence of hydrogen bonds

C. its monobasic nature

D. its geometry.

Answer: B



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60. The type of hybridisation of boron in diborane is

(a) sp , (b) sp^2 , (c) sp^3 , (d) dsp^2

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: C





61. Thermodynamically the most stable form of carbon is

(a) diamond , (b) graphite

(c) fullerenes , (d) coal

A. diamond

B. graphite

C. fullerenes

D. coal

Answer: B



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62. Elements of group 14

(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

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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63. If the starting material for the manufacture of silicones is $RSiCl_3$, write the structure of the product formed.



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