



CHEMISTRY

BOOKS - MTG CHEMISTRY (ENGLISH)

THE P-BLOCK ELEMENTS

Mcqs

1. Which of the following is not the ore of aluminium?

A. Bauxite

B. Cryolite

C. Kernite

D. Corundum

Answer: C



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2. The symbol of element with atomic number 113, is

A. Nh

B. Ni

C. No

D. Nb

Answer: A



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3. How would you explain the lower atomic radii of *Ga* as compared to *Al*?

- A. poor screening effect of d-electrons for the outer electrons from increased nuclear charge
- B. increased force of attraction of increased nuclear charge on electrons
- C. increased ionisation enthalpy of Ga as compared to Al
- D. anomalous behaviour of Ga.

Answer: A



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4. The first ionisation potential of Al is smaller than that of Mg because:

A. the size of Al is bigger than Mg

B. ionisation enthalpy decrease in a period from left to right

C. it is easier to remove electron from unpaired $3p^1$ than from paired $3s^2$

D. aluminium is a passive metal while magnesium is active metal.

Answer: C



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5. The electropositive first increases from B to Al and then decreases from Al to Tl down the group because of

- A. non-metallic nature of B
- B. discrepancies in atomic size of elements
- C. ability of B and Al to form $p\pi - p\pi$ multiple bonds
- D. irregular trend in electronegativity throughout the periodic table.

Answer: B



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6. Group 13 elements show

- A. only + 1 oxidation state

B. only +3 oxidation state

C. + 1 and + 3 oxidation state

D. + 1, + 2 and + 3 oxidation states.

Answer: C



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7. Aluminium exhibits +3 oxidation state. As we move down the group, +1 oxidation state gets more stable.

This is a consequence of

A. increasing size of the atom

B. inert pair effect

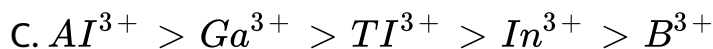
C. electron deficient nature

D. $p\pi - p\pi$ bonding

Answer: B

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8. Group 13 elements show +1 and +3 oxidation states. Relative stability of +3 oxidation may be given as



Answer: B

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9. Which of the following group 13 elements does not show the inert pair effect?

A. Thallium

B. Gallium

C. Indium

D. Aluminium

Answer: D



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10. Among the following oxides, which has the maximum lattice energy?



Answer: D



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11. Describe the shapes of BF_3 and BH_4^- . Assign the hybridisation of boron atom in these species.

A. BF_3 - Trigonal, sp^2 hybridisation,

BH_4^- - square planar, sp^3 hybridisation

B. BF_3 -Triangle, sp^3 hybridisation,

BH_4^- - Hexagonal, sp^2 d hybridisation

C. BF_3 - Trigonal, sp^2 hybridisation,

BH_4^- - Tetrahedral, sp^3 hybridisation

D. BF_3 - Tetrahedral, sp^3 hybridisation

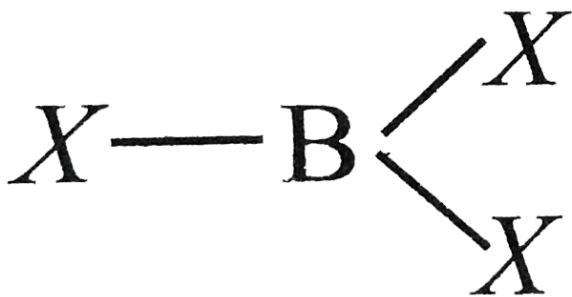
BH_4^- - Tetrahedral, sp^3 hybridisation

Answer: C



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12. In BX_3 B - X distance is shorter than what is expected theoretically because (X = F, Cl, Br, I)



- A. sp^3 hybridisation of B is responsible for shorter B - X distance
- B. B - X has a double bond character due to back-bonding
- C. Dimerisation takes place in BX_3 which is responsible for shorter B - X distance.
- D. Due to large size, of X, B - X distance decreases.

Answer: B



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13. Halides of boron and aluminium are Lewis Acids. Assign reason.

- A. Both halides (MX_3) can accept electrons from a donor to complete their octet.
- B. Both halides (MX_3) can donate a pair of electrons
- C. Both halides (MX_3) are covalent polymeric structures.
- D. Both halides (MX_3) react with water to give hydroxides and HCl

Answer: A



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14. Which of the following is not true regarding the nature of halides of boron?

A. Boron trihalides are covalent

B. Boron trihalides are planar triangular with sp^2 hybridisation

C. Boron trihalides act as Lewis acids.

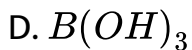
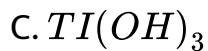
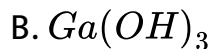
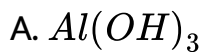
D. Boron trihalides cannot be hydrolysed easily

Answer: D



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15. Which of the following hydroxide is acidic?



Answer: D



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16. The decreasing order of power of boron halides to act as Lewis acids is

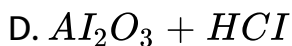
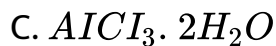
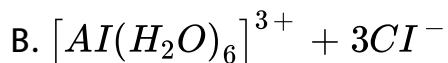
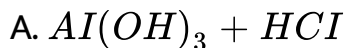




Answer: B

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17. The aqueous solution of $AlCl_3$ is acidic due to



Answer: B

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18. The aqueous solution of $AlCl_3$ is acidic due to

A. Solid $AlCl_3$

B. Dimer Al_2Cl_6

C. $Al(OH)_3$

D. Al_2O_3

Answer: D



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19. Anhydrous aluminium chloride is prepared by

A. reaction of HCl and Al metal

B. reaction of dry HCl gas and metal Al metal

C. passing Conc HNO_3 gas over heated Al metal

D. reaction of Al_2O_3 with dil. HCl

Answer: B

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20. The reduction of an oxide by aluminium is called

A. its highly stable nature

B. its highly unstable nature

C. its amphoteric nature

D. its highly explosive nature.

Answer: A

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21. Why does $AlCl_3$ fumes in air?

- A. It is hygroscopic in nature.
- B. It gives out chlorine when exposed to air.
- C. It is hydrolysed in moist air giving fumes of HCl
- D. It loses water when exposed to moist air.

Answer: C



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22. Which of the following does not show similarity between boron and aluminium?

- A. Both form oxides of type M_2O_3 when heated with oxygen at high temperature
- B. Both dissolve in alkalis and evolve hydrogen.
- C. Hydroxides of both the elements are basic in nature.
- D. Both form nitrides of MN type when heated with N_2 .

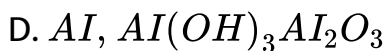
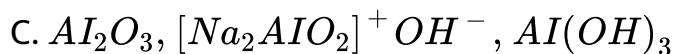
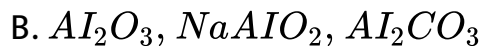
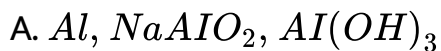
Answer: C



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23. A metal X reacts with aqueous NaOH solution to form Y and a highly inflammable gas. Solution Y is heated and CO_2 is poured through it. Z precipitates out and Na_2CO_3 is formed. Z on the heating gives Al_2O_3 . Identify X, Y and Z.

X Y Z



Answer: A



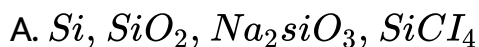
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24. A metal M reacts with sodium hydroxide to give a white precipitate X which is soluble in excess of NaOH to give Y.

Compound X is soluble in HCl to form a compound Z. Identify

M, X, Y and Z

M, X, Y, Z



B. Al , $Al(OH)_3$, $NaMgO_3$, $AlCl_3$

C. Mg , $Mg(OH)_3$, $NaMgO_3$, $MgCl_2$

D. Ca , $Ca(OH)_2$, Na_2CO_3 , $NaHCO_3$

Answer: B



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25. The first member of the p-block elements differs from the remaining members of their corresponding groups due to

A. small size and absence of d-orbitals

B. diagonal relationship with other elements

C. difference in ability to form double and triple bonds

D. high ionisation enthalpy.

Answer: A



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26. Boron is unable to form BF_6^{3-} – ion. Explain.

- A. non-availability of d-orbitals
- B. small size of boron atom
- C. non-metallic nature
- D. less reactivity towards halogens

Answer: A



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27. BF_3 is used as a catalyst in various organic reactions because

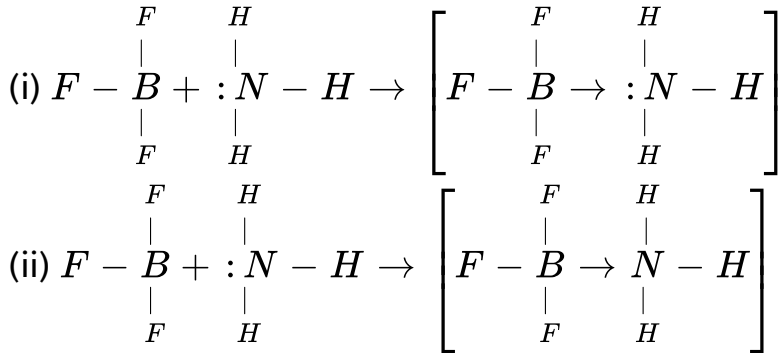
- A. it is a strong reducing agent
- B. it is a highly reactive compound
- C. it is a weak Lewis acid
- D. it is a strong Lewis acid.

Answer: D



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28. Which of the following is correct representatin of the reaction when BF_3 reacts with ammonia?



A. (i) is incorrect and (ii) is correct

B. (i) is correct and (ii) is incorrect

C. Both (i) and (ii) are correct

D. Both (i) and (ii) are incorrect

Answer: B



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29. Chemically borox is

A. sodium metaborate

B. sodium orthoborate

C. sodium tetraborate decahydrate

D. sodium hexaborate

Answer: C



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30. $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} X \xrightarrow{\Delta} Y + Z$, XY and Z in the reaction are

A. $X = Na_2B_4O_7, Y = NaBO_2, Z = B_2O_3$

B. $X = Na_2B_4O_7, Y = B_2O_3, Z = H_3BO_3$

C. $X = B_2O_3, Y = NaBO_2, Z = B(OH)_3$

D. $X = NaBO_2, Y = B_2O_3, Z = B(OH)_3$

Answer: A



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31. $Na_2B_4O_7 + X \rightarrow H_3BO_3$. What is X in the reaction

- A. Aqueous solution of NaOH
- B. Dilute nitric acid
- C. Conc. H_2SO_4 or HCl
- D. water

Answer: C



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

A. Metaborate

B. Tetraborate

C. Triborate

D. orthoborate

Answer: A



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33. What happen when a mixture of cobalt oxide and borax is heated in a flame on a loop of platinum wire?

A. A transparent white heat is formed

B. A bright pink coloured $NaBO_2$ bead is formed.

C. A blue coloured $Co(BO_2)_2$ bead is formed

D. A red coloured $Co(BO_2)_2$ bead is formed.

Answer: C



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34. Borax bead test is responded by :

A. divalent metals

B. heavy metals

C. light metals

D. metals which form coloured metaborates.

Answer: D



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35. Boric acid has polymeric layer structure in which planar BO_3 units are joined by

- A. covalent bonds
- B. two centre-two electron bonds
- C. coordinate bonds
- D. hydrogen bonds.

Answer: D



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36. Boric acid is the trival name for

A. orthoboric acid

B. metaboric acid

C. pyroboric acid

D. none of these

Answer: A



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37. Which of the following compounds are formed when BCl_3 is treated with water?

A. H_3BO_3

B. B_2H_6

C. B_2O_3

D. HBO_2

Answer: A

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38. An aqueous solution of boric acid is found to be weakly acidic in nature. This acidic character arises due to the following reasons.

A. It is a protic acid which donates protons in aqueous solution.

B. It is a Lewis acid which abstracts OH^- from water and leaves H^+ to make to solution acidic

C. It gives metaboric acid when dissolved in water.

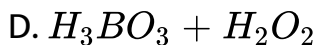
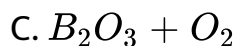
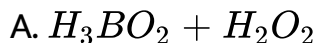
D. It is prepared by reaction of borax with sulphuric acid

hence it behaves as an acid.

Answer: B

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39. Diborane upon hydrolysis gives



Answer: B

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40. What happens when diborane reacts with Lewis bases?

- A. It forms boron trihydride (BH_3) due to cleavage.
- B. It undergoes cleavage to give borane adduct BH_3L
(Where, L = Lewis base)
- C. It oxidises to give B_2O_3
- D. It does not react with Lewis bases

Answer: B



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41. The type of hybridisation of boron in diborane is

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

- A. sp -hybridization
- B. sp^2 -hybridization
- C. sp^3 -hybridization
- D. sp^3d^2 -hybridization

Answer: C

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42. In diborane

- A. Four bridged hydrogen atoms and two terminal hydrogen atoms are present
- B. Two bridged hydrogen atoms and four terminal hydrogen atoms are present

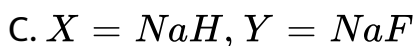
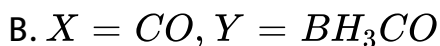
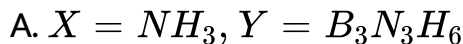
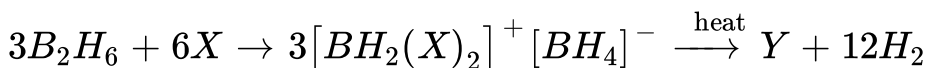
C. three bridged hydrogen atoms and three terminal hydrogen atoms are present

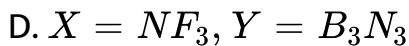
D. there are no bridged hydrogen atoms in diborane, only hydrogen bonds are present.

Answer: B

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43. What are X and Y in the reaction?

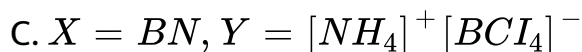
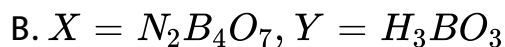
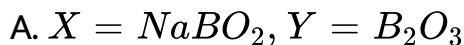
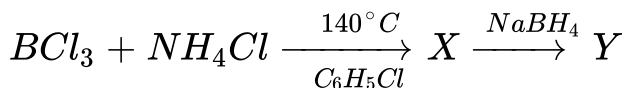




Answer: A

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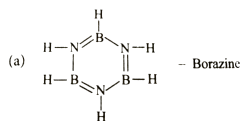
44. Identify X and Y in the following reaction



Answer: D

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45. Which of the following compounds is not matched correctly with its structure?



A.

B. 

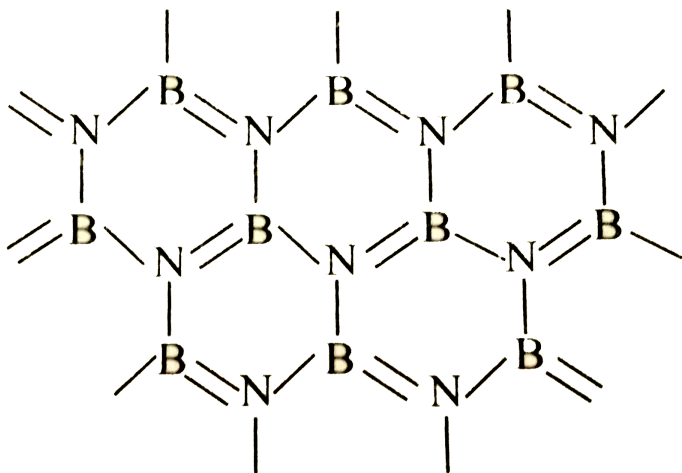


C.

Answer: C

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46. Boron nitride can be represented by the given structure



The structure of BN is similar to

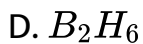
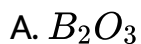
- A. graphite
- B. diamond
- C. benzene
- D. pyridine.

Answer: A



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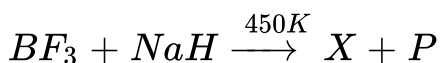
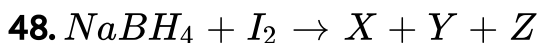
47. Which one of the following is hardest compound of boron ?

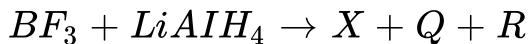


Answer: C



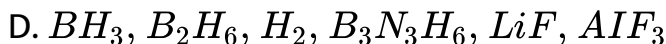
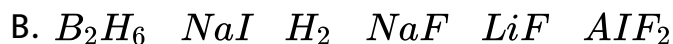
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X, Y, Z, P, Q and R reaction are

X Y Z P Q R



Answer: B



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49. Match the column I with column II and mark the appropriate choice.

Column I	Column II
(A) Borax	(i) Na_3AlF_6
(B) Inorganic benzene	(ii) $Na_2B_4O_7 \cdot 10H_2O$
(C) Cryolite	(iii) $Al_2O_3 \cdot 2H_2O$
(D) Bauxite	(iv) $B_3N_3H_6$

A. (A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)

B. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

C. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (vi)

D. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iv)

Answer: A



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50. Which is not the use of orthoboric acid?

A. As an antiseptic and eye wash.

- B. In glass industry
- C. In glazes for pottery.
- D. In borax - bead test

Answer: D



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51. Borax is not used:

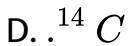
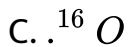
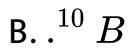
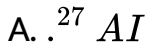
- A. as a styptic to stop bleeding
- B. in making enamel and pottery glazes
- C. as a flux in soldering
- D. in making optical glasses.

Answer: A



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52. Which of the following is used as protective shields in nuclear industries?



Answer: B



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53. Match the column I with column II and mark the appropriate choice

Column I	Column II
(A) Borax-bead	(i) Alum
(B) Inorganic benzene	(ii) Diborane
(C) Antiseptic	(iii) Metaborate
(D) Bridged hydrogens	(iv) Borazine

A. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (ii)

C. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)

D. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (vi), (D) \rightarrow (i)

Answer: B



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54. Match the uses of the metal aluminium given in column I with its properties given in column II and mark the appropriate choice.

Column I

(A) Transmission cable

(B) Aircraft body

(C) Packing industry

(D) Utensils

Column II

(i) High malleability

(ii) High electrical conductivity

(iii) High thermal conductivity

(iv) Light and tough alloys

A. (A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

C. (A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)

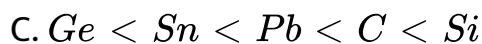
D. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (ii)

Answer: C



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55. The tendency of group 14 elements to show +2 oxidation state increases in the order of



Answer: B



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

A. C

B. Ge

C. Si

D. Pb

Answer: D



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57. Which of the following ions is the most stable?

A. Sn^{2+}

B. Ge^{2+}

C. Si^{2+}

D. Pb^{2+}

Answer: D



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58. All members of groups 14 when heated in oxygen form oxides. Which of the following is the correct trend of oxides?

A. Dioxides CO_2 , SiO_2 and GeO_2 are acidic while SnO_2 and PbO_2 are amphoteric

B. CO , GeO , SnO and PbO are amphoteric

C. Monoxides react with haemoglobin to form toxic compounds.

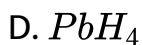
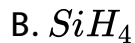
D. All oxides burn with blue flame.

Answer: A



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59. Which of the following species is least stable ?



Answer: B



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60. Identify X in reaction : $X + 2H_2O \xrightarrow[\text{steam}]{\Delta} XO_2 + 2H_2$

A. C

B. Si

C. Ge

D. Sn

Answer: D



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61. The member of group 14 form tetrahalides of the type MX_4 . Which of the following halides cannot be readily hydrolysed by water?

A. CX_4

B. SiX_4

C. GeX_4

D. SnX_4

Answer: A



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62. Which of the following group -14 elements is a radioactive element?

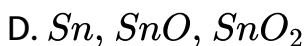
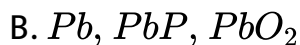
- A. Flerovium
- B. Germanium
- C. Nihonium
- D. Gallium

Answer: A



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63. An element of group 14 forms two oxides one of which is highly poisonous and neutral. Other oxide can be easily liquefied and compressed to give a solid which is used as a refrigerant under the name of drikold. The element and the oxides are



Answer: C



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64. Which is not a characteristic property carbon ?

- A. It exhibits catenation
- B. It forms compounds with multiple bonds.
- C. Its melting point and boiling point are exceptionally high.
- D. It shows semi-metallic character.

Answer: D



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65. Carbon forms a large number of compounds due to :

- A. tetravalency of carbon
- B. strong catenation property of carbon
- C. allotropic property of carbon

D. non-metallic character of carbon

Answer: B

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66. Carbon shows a maximum covalency of four whereas other members can expand their valence due to

- A. absence of d-orbitals in carbon
- B. ability of carbon to form $p\pi - p\pi$ multiple bonds
- C. small size of carbon
- D. catenation of carbon.

Answer: A

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67. Maximum, ability of catenation is shown by,

A. silicon

B. lead

C. germanium

D. carbon

Answer: D



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68. In graphite, each C atom is

A. sp^3

B. sp

C. sp^2

D. None of these

Answer: C



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69. In graphite adjacent layers of carbon atoms are held together by

A. covalent bonds

B. coordinate bonds

C. vander walls forces

D. ionic bonds.

Answer: C



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

- A. In diamond, each carbon is sp^3 hybridised while in graphite each carbon is sp^2 hybridised.
- B. In diamond, carbon atoms are closely packed in crystal lattice while graphite has layer structure
- C. Diamond is a hard substance while graphite is a soft substance

D. Graphite is thermodynamically less stable as compared to diamond and is amorphous form of carbon.

Answer: D

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71. Identify the incorrect statement.

- A. Graphite is thermodynamically most stable allotrope of carbon.
- B. Other forms of elemental carbon like coke, carbon black, charcoal are impure forms of graphite
- C. All allotropes of carbon have thermodynamically different stability.

D. Charcoal and coke are obtained by heating wood in absence of air.

Answer: D

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72. The most stable form of carbon at high temperature is X. The C - C bond length in diamond is Y while C - C bond length in graphite is Z.

What are X,Y and Z respectively?

- A. Graphite 1.42\AA , 1.54\AA
- B. Coke, 1.54\AA , 1.84\AA
- C. Diamond, 1.54\AA , 1.42\AA
- D. Fullerene, 1.54\AA , 1.54\AA

Answer: C



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73. Which of the fullerenes is called Buckminsterfullerene ?

A. graphite

B. diamond

C. C-60

D. quartz

Answer: C



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74. Which of the following does not depict properties of fullerenes?

- A. Fullerenes are made by heating graphite
- B. Fullerenes are pure forms of carbon.
- C. Fullerenes have open cage structure like ice.
- D. C_{60} is called Buckminsterfullerene.

Answer: C



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75. Which of the following is incorrect about graphite ?

- A. For electrodes in batteries

- B. Crucibles made from graphite are used for its inertness
to dilute acids and alkalis
- C. For adsorbing poisonous gases
- D. Lubricant at high temperature.

Answer: C

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76. Match the Column I with column II and mark the appropriate choice.

Column I	Column II
(A) Coal gas	(i) $CO + H_2$
(B) Synthesis gas	(ii) CH_4
(C) Producer gas	(iii) $H_2 + CH_4 + CO$
(D) Natural gas	(iv) $CO + N_2$

A. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (ii)

C. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

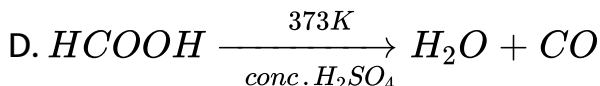
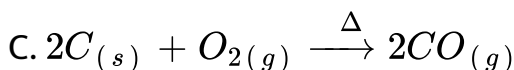
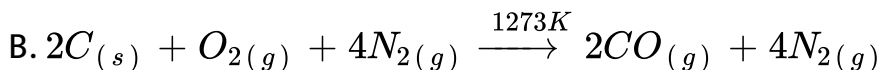
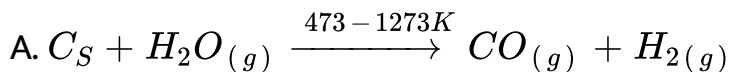
D. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (iv)

Answer: B



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77. Which is not a method of preparing carbon monoxide on a commercial scale?

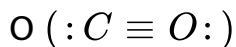


Answer: D

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78. Carbon monoxide acts as a donor and reacts with certain metals to give carbonyls. This is due to

A. presence of one sigma and two pi bonds between C and



B. presence of a lone pair on carbon atom in CO molecule

C. Presence of lone pair on oxygen atom in CO molecule

D. Poisonous nature of CO

Answer: B

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79. Which can act as a reducing agent ?

A. CO

B. CO_2

C. SnO_2

D. PbO_2

Answer: A



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80. When CO_2 is passed through lime water , the milkiness first formed is due to the formation of

A. the reversible reaction taking place

- B. formation of water soluble calcium bicarbonate
- C. huge amount of heat evolved during the reaction
- D. formation of water soluble complex of calcium

Answer: B



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81. which property of CO_2 makes it of biological and geo-chemical importance?

- A. Its acidic nature.
- B. Its colourless and odourless nature
- C. its low solubility in water.
- D. Its high compressibility.

Answer: C



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82. CO_2 is not a poisonous gas but there is increase in concentration of CO_2 in the atmosphere due to burning of fossil fuels and decomposition of limestone. The increase in concentration of CO_2 may lead to

- A. increase in photosynthesis in plants
- B. higher concentration of CO_2 in water
- C. increase in greenhouse effect, thus raising the temperature
- D. increase in formation of metal carbonates

Answer: C



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83. which of the following is not true about structure of carbon dioxide?

A. In CO_2 carbon is sp -hybridised

B. C forms two sigma bonds one with each oxygen atom
and two $p\pi - p\pi$ bonds

C. CO_2 is a linear covalent compound

D. it is a polar molecule

Answer: D



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84. Mark the example which is not correct

A. Non-combustible heavy liquid used as fire extinguisher -



B. Blocks used to shield radioactive materials- lead

C. Element which has property of leaving mark on paper -

graphite

D. A gas in solid form used as a refrigerant- carbon

monoxide

Answer: D



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85. Silicon is an important constituent of

- A. sand
- B. atmosphere
- C. plants
- D. water bodies

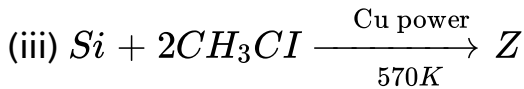
Answer: A



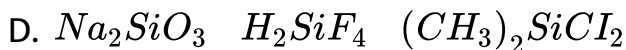
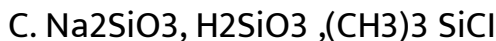
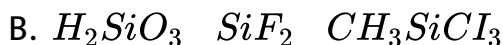
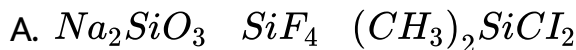
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86. Complete the following reactions: ?





X Y Z



Answer: A



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87. Which of the following is compounds cannot be stored in glass vessels ?

A. HF

B. HCl

C. H_2SO_4

D. HI

Answer: A



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88. Which of the following properties correctly explain SiO_2 ?

A. Linear, basic

B. Tetrahedral, acidic

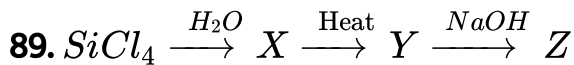
C. Tetrahedral, basic

D. Linear, acidic

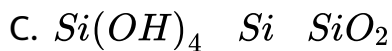
Answer: B



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find X,Y,Z.



Answer: B



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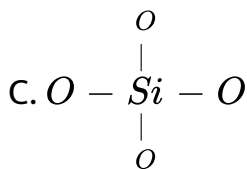
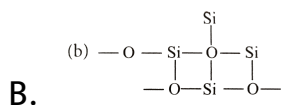
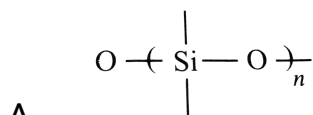
90. Which is incorrect statement about silicones ?

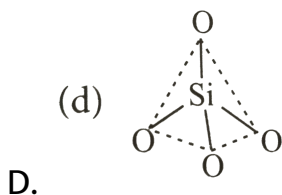
- A. They are made up of SiO_4^{4-} units
- B. They are polymers made up of R_2SiO units
- C. They are water soluble compounds
- D. They are hydrophilic in nature

Answer: B

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91. which of the following bonds is shown in silicones?





Answer: A

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92. An oxide X in the normal form is almost non-reactive due to very high X - O bond enthalpy. It resists the attack by halogens, hydrogen and most of acids and metals even at elevated temperature. It is only attacked by HF and NaOH. The oxide X is.

A. SiO_2

B. CO_2

C. SnO_2

D. PbO_2

Answer: A



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93. What happens when:

(i). Methyl chloride is treated with alcoholic KCN.

(ii). Ethyl chloride is treated with alcoholic KOH.

(iii). Chloroform is heated with Ag powder.

A. Methyl substituted chlorosilanes are formed

B. Only Me_4Si formed

C. Polymerised chains of $(CH_3)_3SiCl$ are formed

D. silicons are formed

Answer: A



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94. $[SiO_4]^{4-}$ has tetrahedral structure, the silicate formed by using the three oxygen has

- A. sheet silicate
- B. double-chain silicate
- C. chain silicates
- D. three-dimensional silicates

Answer: C



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95. Match the Column I with Column II and mark the appropriate choice.

Column I

(A) Galena

(B) Diamond

(C) Carbon monoxide

(D) Silanes

Column II

(i) Abrasive

(ii) Metal carbonyls

(iii) Hydrides of Si

(iv) An ore of lead

A. (A) → (iv), (B) → (ii), (C) → (i), (D) → (iii)

B. (A) → (iv), (B) → (i), (C) → (ii), (D) → (iii)

C. (A) → (ii), (B) → (i), (C) → (iii), (D) → (iv)

D. (A) → (i), (B) → (ii), (C) → (iii), (D) → (iv)

Answer: B



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96. Match the column I with column II and mark the appropriate choice.

Column I

(A) Used as lubricant

(B) Oxide with three dimensional structure

(C) Used in solar cells

(D) Anhydride of carbonic acid

Column II

(i) Carbon dioxide

(ii) Graphite

(iii) Silica

(iv) Silicon

A. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

B. (A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (ii)

C. (A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (i), (D) \rightarrow (iv)

D. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (iv), (D) \rightarrow (i)

Answer: D



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97. Glass and cement are two important examples of

- A. man-made silicates
- B. silicons
- C. zeolites
- D. organic polymers

Answer: A



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98. which of the following is not matched correctly with its use?

- A. Piezoelectric material - Quartz

B. Ion - exchanges - Graphite

C. Filtration plants - Silica

D. Electrical insulators - Silicones

Answer: B



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99. A type of zeolite used to convert alcohols directly into gasoline is

A. zeolite A

B. zeolite L

C. zeolite Beta

D. ZSM-5

Answer: D



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100. Which of the following statements about the zeolites is false?

A. They are used as cation exchangers

B. Some of the SiO_4^{4-} units are replaced by AlO_4^{5-} and AlO_6^{9-} ions in zeolite.

C. They have open structure which enables them to take up small molecules.

D. Zeolites are aluminosilicates having three dimensional structures.

Answer: B



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Higher Order Thinking Skills

1. Identify $(A) + N_2 \xrightarrow{\Delta} (B) \xrightarrow{H_2O} (C) \downarrow (D)_{(g)}$ White
White ppt.
precipitate (C) dissolves in $NaOH$ solution the gas (D) gives
white fumes with HCl .

A. B

B. Al

C. GA

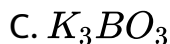
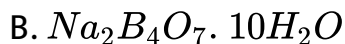
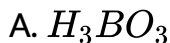
D. C

Answer: B



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2. A compound X is heated with C_2H_5OH and H_2SO_4 the fumes produced burn with green flame. The compound X is



D. none of these

Answer: B

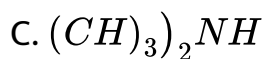
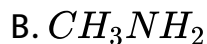


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3. In the following reactions



The amine X will not be -



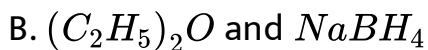
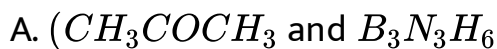
Answer: D



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4. An alkali metal hydride (NaH) reacts with diborane is 'A' to give a tetrahedral compound 'B' which is extensively used as

reducing agent in organic synthesis. The compound d 'A' and 'B' respectively. Are



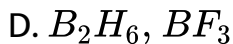
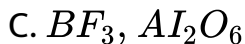
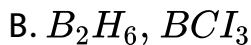
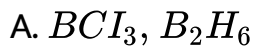
Answer: B



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5. Compound (X) on reduction with $LiAlH_4$ gives a hydride (Y) containing 21.72 % hydrogen along with other products. The compound (Y) reacts with air explosively resulting in formation of boron trioxide. Identify (X) and (Y).

Give balanced reactions involved in the formation of (Y) and its reaction with air. Give the structure of (Y).



Answer: A



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6. An inorganic compound (X) shows the following reactions :

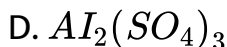
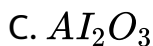
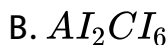
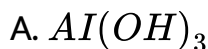
(a) It is white solid, exists as dimer and fumes in moist air.

(b) It sublimes at $180^\circ C$ and forms monomer on heating to $400^\circ C$.

(c) Its aqueous solution turns blue litmus red and gives a white precipitate with $AgNO_3$ solution which is soluble in excess of NH_4OH .

(d) Addition of $NaOH$ to the solution of (A) gives a white gelatinous precipitate which is, however, soluble on excess of $NaOH$.

Identify the compound (A).



Answer: B



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7. The bond dissociation energy of $B - F$ in BF_3 is 646 kJ mol^{-1} whereas that of $C - F$ in CF_4 is 515 kJ mol^{-1} .

The correct reason for higher $B - F$ bond dissociation energy as compared to that of $C - F$ in CF_4 is

A. stronger σ bond between B and F in BF_3 as compared

to that between C and F in CF_4

B. significant $p\pi - p\pi$ interaction between B and F in BF_3

whereas there is no possibility of such interaction

between C and F in CF_4

C. lower degree of $p\pi - p\pi$ interaction between B and F in

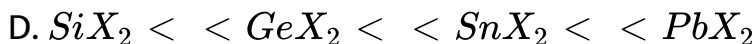
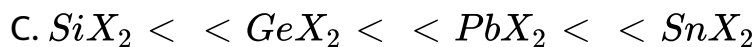
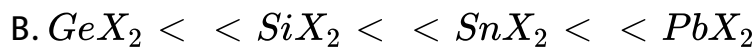
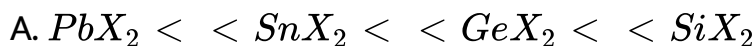
BF_3 than that between C and F in CF_4

D. smaller size of B - atoms as compared to that of C-atom

Answer: B

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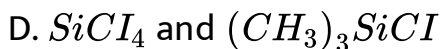
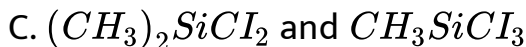
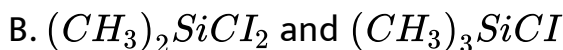
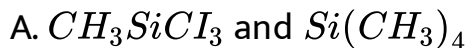
8. vii. The stability of dihalides of *Si*, *Ge*, *Sn* and *Pb* increases steadily in the sequence :



Answer: D

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9. Under hydrolysis conditions, the compounds used for preparation of linear polymer and for chain termination, respectively are



Answer: B



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Exemplar Problems

1. The element which exists in liquid state for a wide range of temperature and can be used for measuring high temperature is

A. B

B. Al

C. Ga

D. In

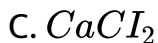
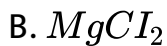
Answer: C



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2. Which of the following is a Lewis acid?

A. $AlCl_3$

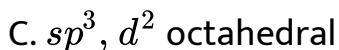
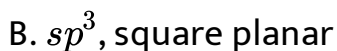


Answer: A



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3. The geometry of a complex species can be understood from the knowledge of type of hybridisation of orbitals of central atom. The hybridisation of orbitals of central atom in $[B(OH_4)]^-$ and the geometry of the complex are respectively.



D. dsp^2 square planar.

Answer: A

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4. Which of the following oxides is acidic in nature?

A. B_2O_3

B. Al_2O_3

C. Ga_2O_3

D. In_2O_3

Answer: A

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5. The exhibition of highest coordination number depends on the availability of vacant orbitals in the central atom. Which of the following elements is not likely to act as central atom in MF_6^{3-} ?

A. B

B. Al

C. Ga

D. In

Answer: A



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6. Boric acid is an acid because its molecule

A. Contains replaceable H^+ ion

B. gives up a proton

C. accepts OH^- from releasing proton

D. combines with proton from water molecule.

Answer: C

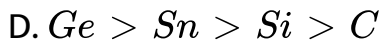
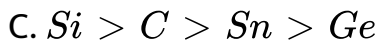


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7. Catenation i.e., linking of similar atoms depends on size and electronic configuration of atoms. The tendency of catenation in group 14 elements follows the order.

A. $C > Si > Ge > Sn$

B. $C > > Si > Ge = Sn$

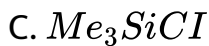


Answer: B

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8. Silicon has a strong tendency to form polymers like silicones.

The chain length of silicone polymer can be controlled by adding



Answer: C



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9. Ionisation enthalpy ($\Delta_t H_{\text{ion}} \text{ in } \text{kJ mol}^{-1}$) for the elements of group-13 follows the order

A. $B > Al > Ga > In > Tl$

B. $B < Al < Ga < In < Tl$

C. $B < Al > Ga < In > Tl$

D. $B > Al < Ga > In < Tl$

Answer: D



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10. In the structure of diborane,

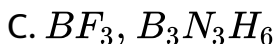
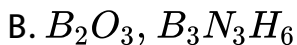
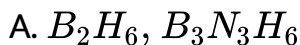
- A. all hydrogen lie in one plane and boron atoms lie in a plane perpendicular to this plane
- B. 2 boron atoms and 4 terminal hydrogen atoms lie in the perpendicular plane
- C. 4 bridging hydrogen atoms and boron atoms lie in one plane and two terminal hydrogen atoms lie in a plane perpendicular to this plane
- D. all the atoms are in the same plane.

Answer: B



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11. A compound X, of boron reacts with NH_3 on heating to give another compound Y which is called inorganic benzene. The compound X can be prepared by treating and Y are represented by the formula.



Answer: A



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12. Quartz is extensively used as a piezoelectric material, it contains

A. Pb

B. Si

C. Ti

D. Sn

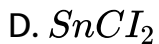
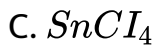
Answer: B



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13. The most commonly used reducing agent is

A. $AlCl_3$



Answer: D



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14. Dry ice is



Answer: C



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15. Cement, the important building material is a mixture of oxides of several elements. Besides calcium, iron and sulphur, oxides of elements of which of the group (s) are present in the mixture ?

- A. Group 2
- B. Groups 2, 13 and 14
- C. Groups 2 and 13
- D. Groups 2 and 14

Answer: B



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Assertion Reason

1. Assertion : In p-block elements, a lot of variation in properties of elements in a group is observed.

Reason : Difference in inner core of electronic configuration greatly influence the physical and chemical properties of elements



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2. Assertion : Compounds formed between non-metals are largely covalent in character.

Reason : Non-metals readily form anions



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3. Assertion:- The heavier P-block elements form strong $\pi - \pi$ bonds.

Reasons:- The heavier elements of p-block form $d\pi - p\pi$ or $d\pi - d\pi$ bonds.

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4. Assertion : Boron forms only covalent compounds. ,

Reason : Boron has very small size.

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

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6. Assertion : Although aluminium is above hydrogen in electrochemical series, it is stable in air and water.

Reason : The thin protective layer of oxide (Al_2O_3) on the surface protects the aluminium.

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7. Assertion : In diborane, each B atom is sp^2 hybridised.

Reason : In diborane, the terminal 2-centre-2-electron B-H bonds are called banana bonds.

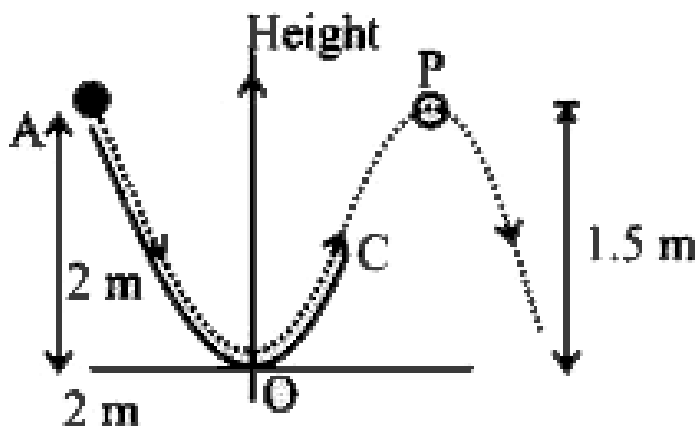
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8. A particle ($m = 3 \text{ kg}$) slides down a frictionless track (AOC) starting from rest at a point A (height 2m). After reaching C,

the particle continues to move freely in air as a projectile.

When it reaching its highest point P (height 1.5 m) the kinetic energy of the particle (in J) is :

Figure drawn is schematic and not to scale , take $g = 10\text{ms}^{-2}$



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9. Assertion : Sn in +2 oxidation state is a reducing agent while Pb in + 4 state is an oxidising agent.

Reason : Inert pair effect is due to participation of s electrons in bond formation.



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10. Assertion : Diamond is the hardest substance on the earth.

Reason : It has high melting point.



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11. Assertion : Fullerenes are the only pure form of carbon.

Reason : It contains twenty, five membered rings and twelve, six membered rings.



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12. Assertion : Carbon monoxide is a poisonous gas

Reason : Carbon monoxide combines with hameoglobin to

form carboxy-haemoglobin which prevents absorption of oxygen by it.

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13. Assertion : In CO_2 molecule C atoms undergoes sp^2 hybridisation

Reason : CO_2 molecule has net dipole moment.

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14. Assertion : CO_2 is a gas at room temperature while SiO_2 is a crystalline solid.

Reason : SiO_2 is a network of silicon and oxygen atoms joined by multiple bonds

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15. Assertion : Zeolites are the three-dimensional network silicates.

Reason : Negative charge on zeolite structure is neutralised by positively charged Al^{3+} ions.



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Group 13 Elements The Boron Family

1. Which of the following is not the ore of aluminium?

A. Bauxite

B. Cryolite

C. Kernite

D. Corundum

Answer: C

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2. The symbol of element with atomic number 113, is

A. Nh

B. Ni

C. No

D. Nb

Answer: A

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3. How would you explain the lower atomic radii of *Ga* as compared to *Al*?

- A. poor screening effect of d-electrons for the outer electrons from increased nuclear charge
- B. increased force of attraction of increased nuclear charge on electrons
- C. increased ionisation enthalpy of Ga as compared to Al
- D. anomalous behaviour of Ga.

Answer: A



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4. The first ionisation potential of Al is smaller than that of Mg because:

- A. the size of Al is bigger than Mg
- B. ionisation enthalpy decrease in a period from left to right
- C. it is easier to remove electron from unpaired $3p^1$ than from paired $3s^2$
- D. aluminium is a passive metal while magnesium is active metal.

Answer: C



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5. The electropositive first increases from B to Al and then decreases from Al to Tl down the group because of

- A. non-metallic nature of B
- B. discrepancies in atomic size of elements
- C. ability of B and Al to form $p\pi - p\pi$ multiple bonds
- D. irregular trend in electronegativity throughout the periodic table.

Answer: B



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6. Group 13 elements show

- A. only + 1 oxidation state

B. only +3 oxidation state

C. + 1 and + 3 oxidation state

D. + 1, + 2 and + 3 oxidation states.

Answer: C



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7. Aluminium exhibits +3 oxidation state. As we move down the group, +1 oxidation state gets more stable.

This is a consequence of

A. increasing size of the atom

B. inert pair effect

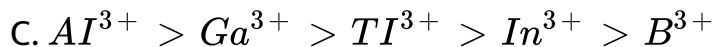
C. electron deficient nature

D. $p\pi - p\pi$ bonding

Answer: B

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8. Group 13 elements show +1 and +3 oxidation states. Relative stability of +3 oxidation may be given as



Answer: B

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9. Which of the following group 13 elements does not show the inert pair effect?

A. Thallium

B. Gallium

C. Indium

D. Aluminium

Answer: D



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10. Among the following oxides, which has the maximum lattice energy?

A. $Ba > AI > Ga > In > TI$

B. $B < AI < Ga < In < TI$

C. $B < AI > Ga < In > TI$

D. $B < AI > Ga > In > TI$

Answer: D



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11. Describe the shapes of BF_3 and BH_4^- . Assign the hybridisation of boron atom in these species.

A. BF_3 - Trigonal, sp^2 hybridisation,

BH_4^- - square planar, sp^3 hybridisation

B. BF_3 -Triangle, sp^3 hybridisation,

BH_4^- - Hexagonal, sp^2 d hybridisation

C. BF_3 - Trigonal, sp^2 hybridisation,

BH_4^- - Tetrahedral, sp^3 hybridisation

D. BF_3 - Tetrahedral, sp^3 hybridisation

BH_4^- - Tetrahedral, sp^3 hybridisation

Answer: C



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12. Halides of boron and aluminium are Lewis Acids. Assign reason.

- A. Both halides (MX_3) can accept electrons from a donor to complete their octet.
- B. Both halides (MX_3) can donate a pair of electrons
- C. Both halides (MX_3) are covalent polymeric structures.
- D. Both halides (MX_3) react with water to give hydroxides and HCl

Answer: A



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13. Which of the following is not true regarding the nature of halides of boron?

A. Boron trihalides are covalent

B. Boron trihalides are planar triangular with sp^2 hybridisation

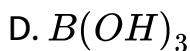
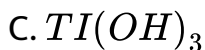
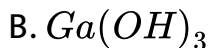
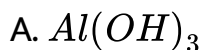
C. Boron trihalides act as Lewis acids.

D. Boron trihalides cannot be hydrolysed easily

Answer: D

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14. Which of the following hydroxide is acidic?



Answer: D



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15. The decreasing order of power of boron halides to act as Lewis acids is

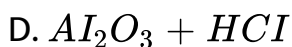
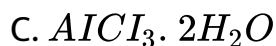
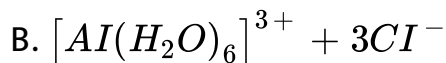
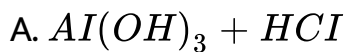


Answer: B



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16. The aqueous solution of $AlCl_3$ is acidic due to

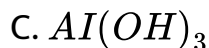
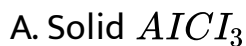


Answer: B



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17. The aqueous solution of $AlCl_3$ is acidic due to



D. Al_2O_3

Answer: D



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18. Anhydrous aluminium chloride is prepared by

A. reaction of HCl and Al metal

B. reaction of dry HCl gas and metal Al metal

C. passing Conc HNO_3 gas over heated Al metal

D. reaction of Al_2O_3 with dil. HCl

Answer: B



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19. The reduction of an oxide by aluminium is called

- A. it highly stable nature
- B. its highly unstable nature
- C. its amphoteric nature
- D. its highly explosive nature.

Answer: A



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20. Why does $AlCl_3$ fumes in air?

- A. It is hygroscopic in nature.
- B. It gives out chlorine when exposed to air.

C. It is hydrolysed in moist air giving fumes of HCl

D. It loses water when exposed to moist air.

Answer: C

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21. Which of the following does not show similarity between boron and aluminium?

A. Both form oxides of type M_2O_3 when heated with oxygen at high temperature

B. Both dissolve in alkalies and evolve hydrogen.

C. Hydroxides of both the elements are basic in nature.

D. Both form nitrides of MN type when heated with N_2 .

Answer: C



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22. A metal X reacts with aqueous NaOH solution to form Y and a highly inflammable gas. Solution Y is heated and CO_2 is poured through it. Z precipitates out and Na_2CO_3 is formed. Z on the heating gives Al_2O_3 . Identify X, Y and Z.

X Y Z

- A. Al , $NaAlO_2$, $Al(OH)_3$
- B. Al_2O_3 , $NaAlO_2$, Al_2CO_3
- C. Al_2O_3 , $[Na_2AlO_2]^+ OH^-$, $Al(OH)_3$
- D. Al , $Al(OH)_3$, Al_2O_3

Answer: A



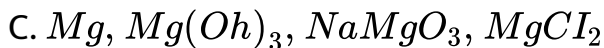
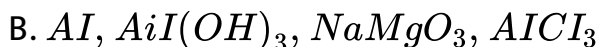
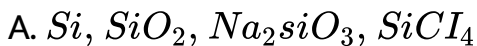
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23. A metal M reacts with sodium hydroxide to give a white precipitate X which is soluble in excess of NaOH to give Y.

Compound X is soluble in HCl to form a compound Z. Identify

M, X, Y and Z

M, X, Y, Z



Answer: B



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Important Trends And Anomalous Properties Of Boron

1. The first member of the p-block elements differs from the remaining members of their corresponding groups due to

- A. small size and absence of d-orbitals
- B. diagonal relationship with other elements
- C. difference in ability to form double and triple bonds
- D. high ionisation enthalpy.

Answer: A



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2. Boron is unable to form BF_6^{3-} – ion. Explain.

- A. non-availability of d-orbitals
- B. small size of boron atom
- C. non-metallic nature
- D. less reactivity towards halogens

Answer: A



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3. BF_3 is used as a catalyst in various organic reactions because

- A. it is a strong reducing agent

B. it is a highly reactive compound

C. it is a weak Lewis acid

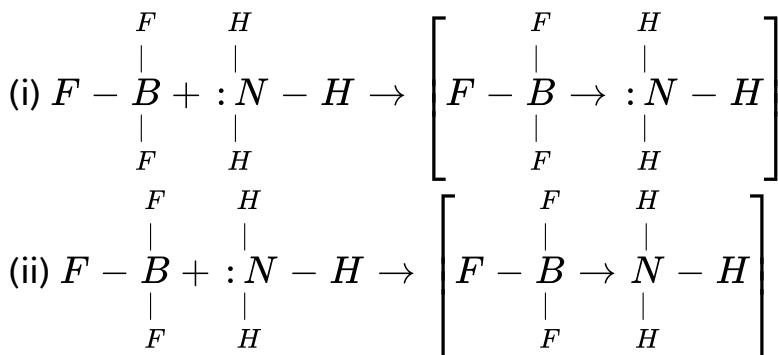
D. it is a strong Lewis acid.

Answer: D



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4. Which of the following is correct representatin of the reaction when BF_3 reacts with ammonia?



A. (i) is incorrect and (ii) is correct

B. (i) is correct and (ii) is incorrect

C. Both (i) and (ii) are correct

D. Both (i) and (ii) are incorrect

Answer: B



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Some Important Compounds Of Boron

1. Chemically borax is

A. sodium metaborate

B. sodium orthoborate

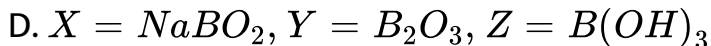
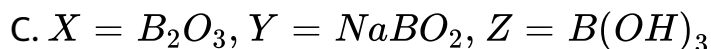
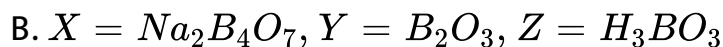
C. sodium tetraborate decahydrate

D. sodium hexaborate

Answer: C

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2. $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} X \xrightarrow{\Delta} Y + Z$, XY and Z in the reaction are



Answer: A

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3. $Na_2B_4O_7 + X \rightarrow H_3BO_3$. What is X in the reaction

A. Aqueous solution of NaOH

B. Dilute nitric acid

C. Conc. H_2SO_4 of HCl

D. water

Answer: C



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

A. Metaborate

B. Tetraborate

C. Triborate

D. orthoborate

Answer: A



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5. What happens when a mixture of cobalt oxide and borax is heated in a flame on a loop of platinum wire?

A. A transparent white heat is formed

B. A bright pink coloured $NaBO_2$ bead is formed.

C. A blue coloured $Co(BO_2)_2$ bead is formed

D. A red coloured $Co(BO_2)_2$ bead is formed.

Answer: C



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6. Borax bead test is responded by :

A. divalent metals

B. heavy metals

C. light metals

D. metals which form coloured metaborates.

Answer: D



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7. Boric acid has polymeric layer structure in which planar BO_3 units are joined by

- A. covalent bonds
- B. two centre-two electron bonds
- C. coordinate bonds
- D. hydrogen bonds.

Answer: D



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8. Boric acid is the trival name for

- A. orthoboric acid

B. metaboric acid

C. pyroboric acid

D. none of these

Answer: A



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9. Which of the following compounds are formed when BCl_3 is treated with water?

A. H_3BO_3

B. B_2H_6

C. B_2O_3

D. HBO_2

Answer: A



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10. An aqueous solution of boric acid is found to be weakly acidic in nature. This acidic character arises due to the following reasons.

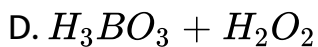
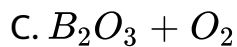
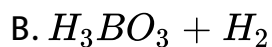
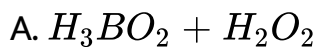
- A. It is a protic acid which donates protons in aqueous solution.
- B. It is a Lewis acid which abstracts OH^- from water and leaves H^+ to make to solution acidic
- C. It gives metaboric acid when dissolved in water.
- D. It is prepared by reaction of borax with sulphuric acid hence it behaves as an acid.

Answer: B



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11. Diborane upon hydrolysis gives



Answer: B



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12. What happens when diborane reacts with Lewis bases?

A. It forms boron trihydride (BH_3) due to cleavage.

B. It undergoes cleavage to give borane adduct BH_3L

(Where, L = Lewis base)

C. It oxidises to give B_2O_3

D. It does not react with Lewis bases

Answer: B



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13. The type of hybridisation of boron in diborane is

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

- A. sp -hybridization
- B. sp^2 -hybridization
- C. sp^3 -hybridization
- D. sp^3d^2 -hybridization

Answer: C

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14. In diborane

- A. Four bridged hydrogen atoms and two terminal hydrogen atoms are present
- B. Two bridged hydrogen atoms and four terminal hydrogen atoms are present

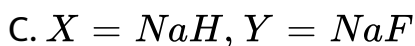
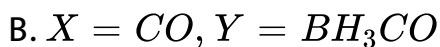
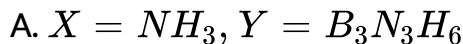
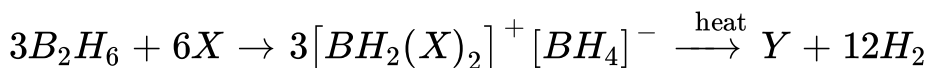
C. three bridged hydrogen atoms and three terminal hydrogen atoms are present

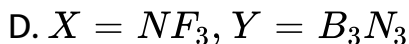
D. there are no bridged hydrogen atoms in diborane, only hydrogen bonds are present.

Answer: B

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15. What are X and Y in the reaction?

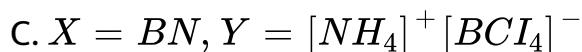
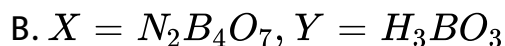
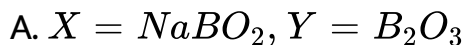
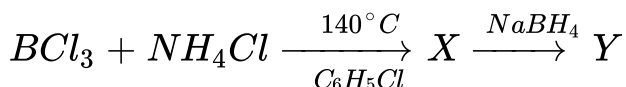




Answer: A

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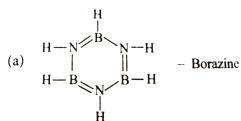
16. Identify X and Y in the following reaction



Answer: D

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17. Which of the following compounds is not matched correctly with its structure?



A.

B. 



C.

Answer: C

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18. Which one of the following is hardest compound of boron ?

A. B_2O_3

B. BN

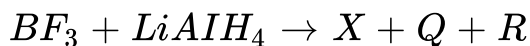
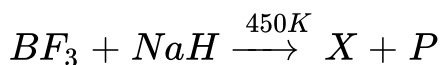
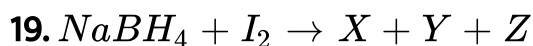
C. B_4C

D. B_2H_6

Answer: C



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X, Y, Z, P, Q and R reaction are

X Y Z P Q R

A. $Na_4B_4O_7$ NaI HI HF LiF AlF_3

B. B_2H_6 NaI H_2 NaF LiF AlF_2

C. B_2H_6 BH_3 NaI $B_3N_3H_6$ Al_2F_6 AlF_3

D. BH_3 , B_2H_6 , H_2 , $B_3N_3H_6$, LiF , AlF_3

Answer: B

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20. Match the column I with column II and mark the appropriate choice.

Column I

(A) Borax

(B) Inorganic benzene

(C) Cryolite

(D) Bauxite

Column II

(i) Na_3AlF_6

(ii) $Na_2B_4O_7 \cdot 10H_2O$

(iii) $Al_2O_3 \cdot 2H_2O$

(iv) $B_3N_3H_6$

A. (A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)

B. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

C. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (vi)

D. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iv)

Answer: A



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Uses Of Boron And Aluminium And Their Compounds

1. Which is not the use of orthoboric acid?

A. As an antiseptic and eye wash.

B. In glass industry

C. In glazes for pottery.

D. In borax - bead test

Answer: D



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2. Borax is not used:

- A. as a styptic to stop bleeding
- B. in making enamel and pottery glazes
- C. as a flux in soldering
- D. in making optical glasses.

Answer: A



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3. Which of the following is used as protective shields in nuclear industries?

A. ^{27}Al

B. ^{10}B

C. ^{16}O

D. ^{14}C

Answer: B



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4. Match the column I with column II and mark the appropriate choice

Column I

Column II

(A) Borax-bead

(i) Alum

(B) Inorganic benzene

(ii) Diborane

(C) Antiseptic

(iii) Metaborate

(D) Bridged hydrogens

(iv) Borazine

A. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (ii)

C. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)

D. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (vi), (D) \rightarrow (i)

Answer: B



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Group 14 Elements The Carbon Family

1. Match the uses of the metal aluminium given in column I with its properties given in column II and mark the appropriate choice.

Column I

(A) Transmission cable

(B) Aircraft body

(C) Packing industry

(D) Utensils

Column II

(i) High malleability

(ii) High electrical conductivity

(iii) High thermal conductivity

(iv) Light and tough alloys

A. (A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

C. (A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)

D. (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (ii)

Answer: C



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2. The tendency of group 14 elements to show +2 oxidation state increases in the order of

A. $C < Si < Sn < Pb < Ge$

B. $C < Si < Ge < Sn < Pb$

C. $Ge < Sn < Pb < C < Si$

D. $Pb < Sn < Ge < C < Si$

Answer: B

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

A. C

B. GE

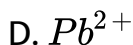
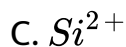
C. Si

D. Pb

Answer: D

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4. Which of the following ions is the most stable?



Answer: D



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5. All members of groups 14 when heated in oxygen form oxides. Which of the following is the correct trend of oxides?

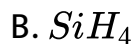
- A. Dioxides CO_2 , SiO_2 and GeO_2 are acidic while SnO_2 and PbO_2 are amphoteric
- B. CO , GeO , SnO and PbO are amphoteric
- C. Monoxides react with haemoglobin to form toxic compounds.
- D. All oxides burn with blue flame.

Answer: A



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6. Which of the following species is least stable ?



C. SnH_4

D. PbH_4

Answer: B

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7. Identify X in reaction : $X + 2H_2O \xrightarrow[\text{steam}]{\Delta} XO_2 + 2H_2$

A. C

B. Si

C. Ge

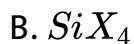
D. Sn

Answer: D

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8. The member of group 14 form tetrahalides of the type MX_4 .

Which of the following halides cannot be readily hydrolysed by water?



Answer: A



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9. Which of the following group -14 elements is a radioactive element?

A. Flerovium

B. Germanium

C. Nihonium

D. Gallium

Answer: A



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10. An element of group 14 forms two oxides one of which is highly poisonous and neutral. Other oxide can be easily liquefied and compressed to give a solid which is used as a

refrigerant under the name of drikold. The element and the oxides are

A. *Si, SiO, SiO₂*

B. *Pb, PbP, PbO₂*

C. *C, CO, CO₂*

D. *Sn, SnO, SnO₂*

Answer: C



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Important Trends And Anomalous Properties Of Carbon

1. Which is not a characteristic property carbon ?

- A. It exhibits catenation
- B. It forms compounds with multiple bonds.
- C. Its melting point and boiling point are exceptionally high.
- D. It shows semi-metallic character.

Answer: D



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2. Carbon forms a large number of compounds due to :

- A. tetravalency of carbon
- B. strong catenation property of carbon
- C. allotropic property of carbon

D. non-metallic character of carbon

Answer: B

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3. Carbon shows a maximum covalency of four whereas other members can expand their valence due to

A. absence of d-orbitals in carbon

B. ability of carbon to form $p\pi - p\pi$ multiple bonds

C. small size of carbon

D. catenation of carbon.

Answer: A

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4. Maximum, ability of catenation is shown by,

A. silicon

B. lead

C. germanium

D. carbon

Answer: D



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Allotropes Of Carbon

1. In graphite, each C atom is

A. sp^3

B. sp

C. sp^2

D. None of these

Answer: C



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2. In graphite adjacent layers of carbon atoms are held together by

A. covalent bonds

B. coordinate bonds

C. vander walls forces

D. ionic bonds.

Answer: C



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

A. In diamond, each carbon is sp^3 hybridised while in graphite each carbon is sp^2 hybridised.

B. In diamond, carbon atoms are closely packed in crystal lattice while graphite has layer structure

C. Diamond is a hard substance while graphite is a soft substance

D. Graphite is thermodynamically less stable as compared to diamond and is amorphous form of carbon.

Answer: D

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4. Identify the incorrect statement.

A. Graphite is thermodynamically most stable allotrope of carbon.

B. Other forms of elemental carbon like coke, carbon black, charcoal are impure forms of graphite

C. All allotropes of carbon have thermodynamically different stability.

D. Charcoal and coke are obtained by heating wood in absence of air.

Answer: D

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5. The most stable form of carbon at high temperature is X. The C - C bond length in diamond is Y while C - C bond length in graphite is Z.

What are X,Y and Z respectively?

A. Graphite 1.42\AA , 1.54\AA

B. Coke, 1.54\AA , 1.84\AA

C. Diamond, 1.54\AA , 1.42\AA

D. Fullerene, 1.54\AA , 1.54\AA

Answer: C



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6. Which of the fullerenes is called Buckminsterfullerene ?

A. graphite

B. diamond

C. C-60

D. quartz

Answer: C



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7. Which of the following does not depict properties of fullerenes?

- A. Fullerenes are made by heating graphite
- B. Fullerenes are pure forms of carbon.
- C. Fullerenes have open cage structure like ice.
- D. C_{60} is called Buckminsterfullerene.

Answer: C



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8. Which of the following is incorrect about graphite ?

- A. For electrodes in batteries

- B. Crucibles made from graphite are used for its inertness to dilute acids and alkalies
- C. For adsorbing poisonous gases
- D. Lubricant at high temperature.

Answer: C

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Some Important Compounds Of Carbon

1. Match the Column I with column II and mark the appropriate choice.

Column I	Column II
(A) Coal gas	(i) $CO + H_2$
(B) Synthesis gas	(ii) CH_4
(C) Producer gas	(iii) $H_2 + CH_4 + CO$
(D) Natural gas	(iv) $CO + N_2$

A. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

B. (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (ii)

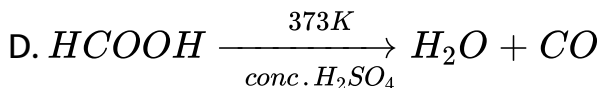
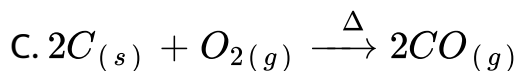
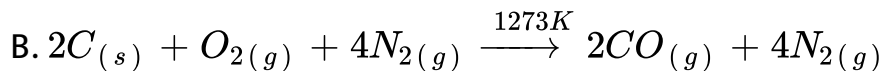
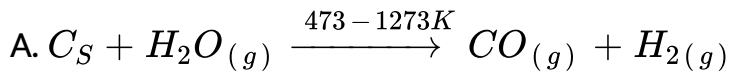
C. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

D. (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (iv)

Answer: B

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2. Which is not a method of preparing carbon monoxide on a commercial scale?

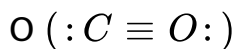


Answer: D

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3. Carbon monoxide acts as a donor and reacts with certain metals to give carbonyls. This is due to

A. presence of one sigma and two pi bonds between C and



B. presence of a lone pair on carbon atom in CO molecule

C. Presence of lone pair on oxygen atom in CO molecule

D. Poisonous nature of CO

Answer: B

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4. Which can act as a reducing agent ?

A. CO

B. CO_2

C. SnO_2

D. PbO_2

Answer: A

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5. When CO_2 is passed through lime water, the milkiness first formed is due to the formation of

- A. the reversible reaction taking place
- B. formation of water soluble calcium bicarbonate
- C. huge amount of heat evolved during the reaction
- D. formation of water soluble complex of calcium

Answer: B



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6. which property of CO_2 makes it of biological and geo-chemical importance?

- A. Its acidic nature.
- B. Its colourless and odourless nature
- C. its low solubility in water.
- D. Its high compressibility.

Answer: C

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7. CO_2 is not a poisonous gas but there is increase in concentration of CO_2 in the atmosphere due to burning of fossil fuels and decomposition of limestone. The increase in concentration of CO_2 may lead to

- A. increase in photosynthesis in plants
- B. higher concentration of CO_2 in water

C. increase in greenhouse effect, thus raising the temperature

D. increase in formation of metal carbonates

Answer: C



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8. which of the following is not true about structure of carbon dioxide?

A. In CO_2 carbon is sp -hybridised

B. C forms two sigma bonds one with each oxygen atom and two $p\pi - p\pi$ bonds

C. CO_2 is a linear covalent compound

D. it is a polar molecule

Answer: D



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9. Mark the example which is not correct

A. Non-combustible heavy liquid used as fire extinguisher -



B. Blocks used to shield radioactive materials- lead

C. Element which has property of leaving mark on paper -

graphite

D. A gas in solid form used as a refrigerant- carbon

monoxide

Answer: D



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10. Silicon is an important constituent of

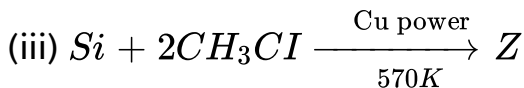
- A. sand
- B. atmosphere
- C. plants
- D. water bodies

Answer: A

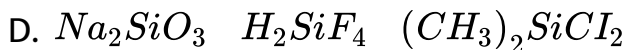
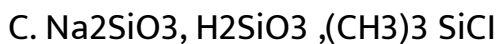
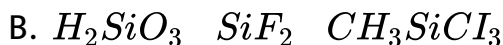
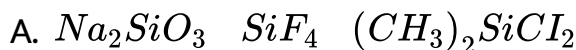


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11. Complete the following reactions: ?



$X \quad Y \quad Z$



Answer: A



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12. Which of the following is compounds cannot be stored in glass vessels ?

A. HF

B. HCl

C. H_2SO_4

D. HI

Answer: A



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13. Which of the following properties correctly explain SiO_2 ?

A. Linear, basic

B. Tetrahedral, acidic

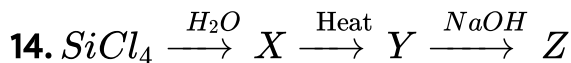
C. Tetrahedral, basic

D. Linear, acidic

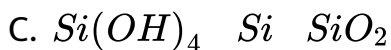
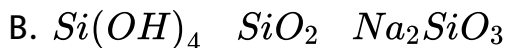
Answer: B



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find X,Y,Z.



Answer: B



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15. Which is incorrect statement about silicones ?

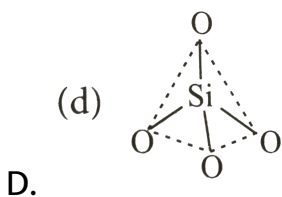
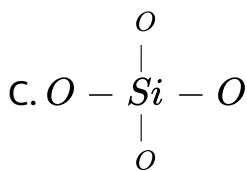
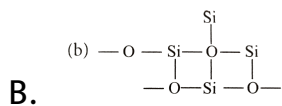
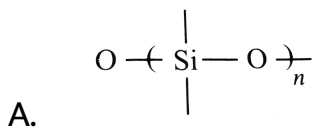
- A. They are made up of SiO_4^{4-} units
- B. They are polymers made up of R_2SiO units
- C. They are water soluble compounds
- D. They are hydrophilic in nature

Answer: B



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16. which of the following bonds is shown in silicones?

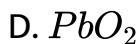
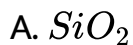


Answer: A



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17. An oxide X in the normal form is almost non-reactive due to very high X - O bond enthalpy. It resists the attack by halogens, hydrogen and most of acids and metals even at elevated temperature. It is only attacked by HF and NaOH. The oxide X is.



Answer: A



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18. What happens when:

(i). Methyl chloride is treated with alcoholic KCN.

(ii). Ethyl chloride is treated with alcoholic KOH.

(iii). Chloroform is heated with Ag powder.

A. Methyl substituted chlorosilanes are formed

B. Only Me_4Si formed

C. Polymerised chains of $(CH_3)_3SiCl$ are formed

D. silicons are formed

Answer: A



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19. $[SiO_4]^{4-}$ has tetrahedral structure, the silicate formed by using the three oxygen has

- A. sheet silicate
- B. double-chain silicate
- C. chain silicates
- D. three-dimensional silicates

Answer: C



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20. Match the Column I with Column II and mark the appropriate choice.

Column I

Column II

(A) Galena

(i) Abrasive

(B) Diamond

(ii) Metal carbonyls

(C) Carbon monoxide

(iii) Hydrides of Si

(D) Silanes

(iv) An ore of lead

A. (A) \rightarrow (iv), (B) \rightarrow (ii), (C) \rightarrow (i), (D) \rightarrow (iii)

B. (A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (ii), (D) \rightarrow (iii)

C. (A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (iv)

D. (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)

Answer: B



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21. Match the column I with column II and mark the appropriate choice.

Column I

(A) Used as lubricant

(B) Oxide with three dimensional structure

(C) Used in solar cells

(D) Anhydride of carbonic acid

Column II

(i) Carbon dioxide

(ii) Graphite

(iii) Silica

(iv) Silicon

A. (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (i)

B. (A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (ii)

C. (A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (i), (D) \rightarrow (iv)

D. (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (iv), (D) \rightarrow (i)

Answer: D



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22. Glass and cement are two important examples of

A. man-made silicates

B. silicons

C. zeolites

D. organic polymers

Answer: A



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23. which of the following is not matched correctly with its use?

A. Piezoelectric material - Quartz

B. Ion - exchanges - Graphite

C. Filtration plants - Silica

D. Electrical insulators - Silicones

Answer: B



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24. A type of zeolite used to convert alcohols directly into gasoline is

- A. zeolite A
- B. zeolite L
- C. zeolite Beta
- D. ZSM-5

Answer: D



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25. Which of the following statements about the zeolites is false?

A. They are used as cation exchangers

B. Some of the SiO_4^{4-} units are replaced by AlO_4^{5-} and AlO_6^{9-} ions in zeolite.

C. They have open structure which enables them to take up small molecules.

D. Zeolites are aluminosilicates having three dimensional structures.

Answer: B



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1. The element which exists in liquid state for a wide range of temperature and can be used for measuring high temperature is

A. B

B. Al

C. Ga

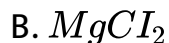
D. In

Answer: C



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2. Which of the following is a Lewis acid?

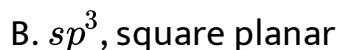


Answer: A



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3. The geometry of a complex species can be understood from the knowledge of type of hybridisation of orbitals of central atom. The hybridisation of orbitals of central atom in $[B(OH_4)]^-$ and the geometry of the complex are respectively.



C. sp^3, d^2 octahedral

D. dsp^2 square planar.

Answer: A

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4. Which of the following oxides is acidic in nature?

A. B_2O_3

B. Al_2O_3

C. Ga_2O_3

D. In_2O_3

Answer: A

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5. The exhibition of highest coordination number depends on the availability of vacant orbitals in the central atom. Which of the following elements is not likely to act as central atom in MF_6^{3-} ?

A. B

B. Al

C. Ga

D. In

Answer: A



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6. Boric acid is an acid because its molecule

- A. Contains replaceable H^+ ion
- B. gives up a proton
- C. accepts OH^- from releasing proton
- D. combines with proton from water molecule.

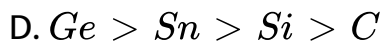
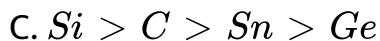
Answer: C



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7. Catenation i.e., linking of similar atoms depends on size and electronic configuration of atoms. The tendency of catenation in group 14 elements follows the order.

A. $C > Si > Ge > Sn$



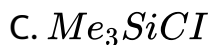
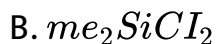
Answer: B



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8. Silicon has a strong tendency to form polymers like silicones.

The chain length of silicone polymer can be controlled by adding



D. Me_4Si

Answer: C

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9. Ionisation enthalpy ($\Delta_t H_i$ in $kJ\ mol^{-1}$) for the elements of group-13 follows the order

A. $B > Al > Ga > In > Tl$

B. $B < Al < Ga < In < Tl$

C. $B < Al > Ga < In > Tl$

D. $B > Al < Ga > In < Tl$

Answer: D

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10. In the structure of diborane,

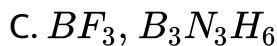
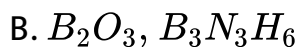
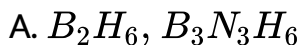
- A. all hydrogen lie in one plane and boron atoms lie in a plane perpendicular to this plane
- B. 2 boron atoms and 4 terminal hydrogen atoms lie in the perpendicular plane
- C. 4 bridging hydrogen atoms and boron atoms lie in one plane and two terminal hydrogen atoms lie in a plane perpendicular to this plane
- D. all the atoms are in the same plane.

Answer: B



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11. A compound X, of boron reacts with NH_3 on heating to give another compound Y which is called inorganic benzene. The compound X can be prepared by treating and Y are represented by the formula.



Answer: A



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12. Quartz is extensively used as a piezoelectric material, it contains

A. Pb

B. Si

C. Ti

D. Sn

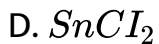
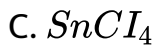
Answer: B



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13. The most commonly used reducing agent is

A. $AlCl_3$



Answer: D



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14. Dry ice is



Answer: C



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15. Cement, the important building material is a mixture of oxides of several elements. Besides calcium, iron and sulphur, oxides of elements of which of the group (s) are present in the mixture ?

- A. Group 2
- B. Groups 2, 13 and 14
- C. Groups 2 and 13
- D. Groups 2 and 14

Answer: B



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1. Assertion : In p-block elements, a lot of variation in properties of elements in a group is observed.

Reason : Difference in inner core of electronic configuration greatly influence the physical and chemical properties of elements

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2. Assertion : Compounds formed between non-metals are largely covalent in character.

Reason : Non-metals readily form anions

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3. Assertion:- The heavier P-block elements form strong $\pi - \pi$ bonds.

Reasons:- The heavier elements of p-block form $d\pi - p\pi$ or $d\pi - d\pi$ bonds.

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4. Assertion : Boron forms only covalent compounds. ,

Reason : Boron has very small size.

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

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6. Assertion : Although aluminium is above hydrogen in electrochemical series, it is stable in air and water.

Reason : The thin protective layer of oxide (Al_2O_3) on the surface protects the aluminium.

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7. Assertion : In diborane, each B atom is sp^2 hybridised.

Reason : In diborane, the terminal 2-centre-2-electron B-H bonds are called banana bonds.

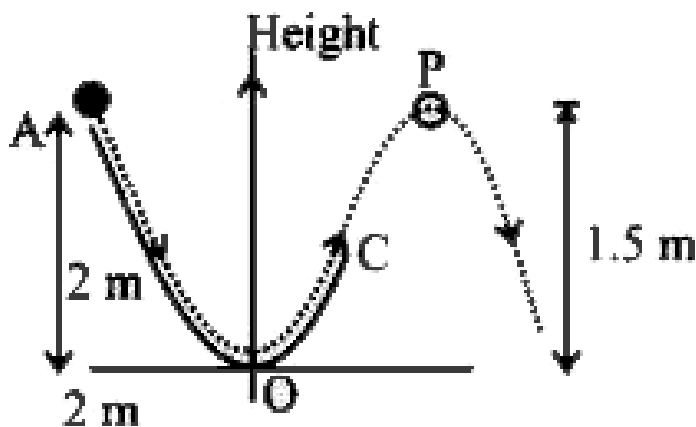
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8. A particle ($m = 3 \text{ kg}$) slides down a frictionless track (AOC) starting from rest at a point A (height 2m). After reaching C,

the particle continues to move freely in air as a projectile.

When it reaching its highest point P (height 1.5 m) the kinetic energy of the particle (in J) is :

Figure drawn is schematic and not to scale , take $g = 10\text{ms}^{-2}$



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9. Assertion : Sn in +2 oxidation state is a reducing agent while Pb in + 4 state is an oxidising agent.

Reason : Inert pair effect is due to participation of s electrons in bond formation.



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10. Assertion : Diamond is the hardest substance on the earth.

Reason : It has high melting point.



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11. Assertion : Fullerenes are the only pure form of carbon.

Reason : It contains twenty, five membered rings and twelve, six membered rings.



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12. Assertion : Carbon monoxide is a poisonous gas

Reason : Carbon monoxide combines with hameoglobin to

form carboxy-haemoglobin which prevents absorption of oxygen by it.

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13. Assertion : In CO_2 molecule C atoms undergoes sp^2 hybridisation

Reason : CO_2 molecule has net dipole moment.

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14. Assertion : CO_2 is a gas at room temperature while SiO_2 is a crystalline solid.

Reason : SiO_2 is a network of silicon and oxygen atoms joined by multiple bonds

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15. Assertion : Zeolites are the three-dimensional network silicates.

Reason : Negative charge on zeolite structure is neutralised by positively charged Al^{3+} ions.



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