CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

SOME p-BLOCK ELEMENTS

Curiosity Questions

1. What material is used prepare bullet proof vests ?

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2. Nitric acid is highly corrosive and a strong oxidising agent. To avoid accidents caused by possible breakage of glass containers during transportations, what other unbreakable containers can be used

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3. What is tin plague ?

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4. Why does water carried through lead pipes becomes poisonous ?

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Test Your Grip Multiple Choice Questions

1. Which of the following is only acidic in nature

A. $Be(OH)_2$

B. $Mg(OH)_2$

C. $B(OH)_3$

D. $Al(OH)_3$

Answer:

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2. Which of the following impart gree colour to the burner flame ?

A. $B(OMe)_3$

B. $NaOMe$

C. $Al(OPr)_3$

D. $Sn(OH)_2$

Answer:

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3. Which of the following does not exist in free state

A. BF_3

B. BCl_3

C. BBr_3

D. BH_3

Answer:

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4. Among the halids (i) BCl_3, (ii) $AlCl_3$, (iii) $GaCl_3$ (iv) $InCl_3$, the order of decreasing Lewis acid characters is

A. (i), (ii), (iii), (iv)

B. (iv), (iii), (ii), (i)

C. (iii), (iv), (ii), (i)

D. (ii), (iii), (iv), (i)

Answer:

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5. $H_3BO_3$is

A. Monobasic and weak Lewis acid

B. Monibasic and weak Bronsted acid

C. Monobasic and strong Lewis acid

D. Tribasic and weak Bronsted acid

Answer:

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6. A metal, M forms chlorides in $+2$ and $+4$ oxidation states. Which of the following statement about these chlorides is correct ?

A. MCl_2 is more volatile than MCl_4

B. MCl_2 is more soluble in anyhydrous ethanol than MCl_4.

C. MCl_2 is more ionic than MCl_4

D. MCl_2 is more easily hydrolysed than MCl_4.

Answer:

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7. $PbCl_4$ exists but $PbBr_4$ and PbI_4 do not because of

A. Chlorine is more electropositive

B. Iodine and bromine are of large size

C. Iodine and bromine are unable to oxidies Pb to Pb^{4+}

D. Bromine and iodine are stronger oxidising agents than chlorine.

Answer:

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8. Which gas is evolved when PbO_2 is treated with conc. HNO_3 ?

A. NO

B. O_2

C. N_2

D. N_2O

Answer:

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9. Which of the following statement about buckyball is incorrect ?

A. It is C_{60} allotrope of carbon

B. All the carbon atoms are sp^3-hybridized

C. It contains 20 six membred rings and 12 five-membered rings.

D. Five membered rings are connected both on five and six-membered rings

Answer:

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10. How many O-atoms are shared per SiO_4 tetrahedra in silicate anion of beryl mineral ?

A. 1

B. 4

C. 3

D. 2

Answer: D

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Test Your Grip Fill In The Blanks

1. The existence of lower oxidation state than the group oxidation state of group 13 and 14 elements is explained on the basis of . . . .

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2. The most stable oxidation state of aluminum is …….. while that of thallium is ……..

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3. Tl^{3+} acts an …….. agent.

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4. Boron forms only …….. compounds while aluminium forms both …….. and ……..compounds.

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5. Aluminium is ..... in nature and dissolves in both dilute hydrochloric acid and sodium hydroxide evolving ..... gas.

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6. Boron compouns act as Lewis acid because of their ..... nature.

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7. $AlCl_3$ is a Less acidic than BCl_3.True or False

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8. When treated with conc. HNO_3 aluminium is rendered ..... due to the formation of protective layer of its ..... on the surface of the metal.

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9. Orthoboric acid on strong heating gives . . . . . .

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10. The molecular formula of inorganic benzene is . . . . . and is obtained by heating the adduct of . . . . . with . . . . . .

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11. The two types of bonds present in diborane are . . . . . and . . . . . .

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12. An alloy of copper and aluminium which has beautiful golden yellow colour is called .....

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13. The structure of $N(CH_3)_3$ is ..... while that of $N(SiH_3)_3$ is .....

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14. $SnCl_2$ acts as a ..... agent.

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15. On reactly discovered allotrope, C_{60}, is known as .....

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16. The $C - C$ bond length in diamond is ....while in graphite it is ....

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17. .... is produced by action of conc. H_2SO_4 on potassium ferrocyanide.

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18. Dehydration of formic acid gives ....

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19. Out of CO and CO_2, ... forms complexes.

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20. The basis building unit of silicates is . . . . . .

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Conceptual Questions Group 13 Elements

1. The $+1$ oxidation state is more stable than the +3 oxidation state for thallium. Explain why ?

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2. Assign reasons for each of the following : (i) + 1 gallium undergoes disproportionation reactions.

(ii) Unlike In^+, Ti^+ is more stable with respect to disproportionation.

(ii) $InCl$ undergoes disproportionation but $TlCl$ does not.

(iv) $In(III)$ is more stable than $In(I)$ aqueous solution.

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3. How to boron obtained from borax ? Give chemical equations with reaction conditions. Write the structure of B_2H_6 and its reaction with HCl.

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4. Why does not boron form B^{3+} ions ?

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5. Why boron and aluminium tend to form covalent compounds ?

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6. Aluminium fluorirde is ionic but aluminium chloride is covalent. Explain

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7. Molten aluminium bromide is poor conductor of electricity. Explain.

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8. Why boron forms electron deficient compounds?

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9. Why boron halides do not exists as a dimer. While $AlCl_3$ exists as Al_2Cl_6 ?

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10. Aluminium chloride exists as dimer. Give reason.

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11. Anhydrous aluminium chloride is used as a catalyst.

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12. Why trihalides of group 13 elements fume in moist air?

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13. BCl_3 is trigonal planar while $AlCl_3$ is tetrahedral in dimeric state. Explain .

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14. Why BBr_3 is a stronger Lewis acid as compared to BF_3 through florine is more electronegative than bromine ?

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15. Why $B-X$ bond distance in BX_3 is shorter than theoretically expected value ?

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16. Boric acid can be titrated against sodium hydroxide using methyl orange as indicator only in the presence of polyhydroxy compounds wlike catechol, manniton etc. explain.

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17. State with equations what happens when borax is heated on a platinum wire loop and to the resulting transparent mass, a minute amount of CuO is added and the mixture is again heated first in the oxidising flame and then in the reducing flame of a Bunsen burner?

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Conceptual Questions Group 14 Elements

1. C and Si are always tetravalent , but Ge, Sn and Pb show divalency Give reason .

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2. Tendency to exhibit $+2$ oxidation state increases with increasing atomic number among group 14 elements . Explain.

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3. Why is+2oxidiation state of lead more stable than +4 oxidation state?

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4. Why carbon froms covalent compounds whereas lead forms ionic compounds ?

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5. Give one chemical reaction to show that :

(i) $Sn(II)$ is a reducing agent whereas $Pb(II)$ is not.

(ii) $Sn(II)$ chloride is a reducing agent.

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6. PbO_2 acts as a stronger oxidising agent than SnO_2. Cmment .

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7. PbO_2 can act as an oxidising agent.

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8. Carbon monoxide is readily absorbed by ammoniacal cuprous chloride solution but carbon dioxide is not. Explain .

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9. CO is stable , but analogous SiO is not stable . Why ?

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10. Why $N(CH_3)_3$ is pyramidal but $N(SiH_3)_3$ is planar ?

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11. (SiH_3) is a weaker base than $(CH_3)_3$N. Explain.

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12. Why $N(CH_3)_3$ is more basic than $N(SiMe_3)_3$?

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13. Account for the following : (i) PbX_2 is more stable than $PbX_4(X = Cl, Br)$

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

(iii) $PbCl_4$ is less stable than $SnCl_4$?

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14. Why CCl_4 is resistant to hydrolysis , but $SiCl_4$ is readily hudrolgysed ?

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15. The tendency towards catenation among group 14 elements down the group

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16. why carbon show catenation but silicon does not ?

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17. Give reason : Down the group tendency for catenation decreases among group 14 elements .

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18. Silanes are few in number whereas alkanes are large in number . Explain .

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19. Why does not sillicon form an analogue of graphite?

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20. Why does elemental silicon not form graphite like structure as carbon does. Explain.

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21. No form fo elecmental silicon is comparabnle to graphite Give reason .

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22. CO_2 is a gas while SiO_2 is a solid. Explain.

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Ncert Questions And Exercises With Answers Ncert Intext Solved Questions

1. Standard electrode potential values, E° at Al^{3+}/Al is $-1.66V$ and that of Tl^{3+}/Tl is $+1.26V$. Predict about the formation of M^{3+} ions in solution and compare the electropositive character of the two metals.

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2. White fumes appear around the bottle of anhydrous aluminium chloride. Give reason.

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

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

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5. In elements of group 14.

(a) which forms the most acidic oxide

(b) Which is normally found in +2 oxidation state

(c) which is used as semi conductor?

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6. $[SiF_6]^{2-}$ is known where as $[SiCl_6]^{2-}$ not. Reason is

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

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8. What are silicones ?

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9. What happens when

(a) Borax is heated strongly,

(b) Boric acid is added to water,

(c) Aluminium is treated with dilute NaOH,

(d) BF_3 is reacted with ammonia ?

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10. Explain the following reactions

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

(b) Silicon dioxide is treated with hydrogen fluoride,

(c) CO is heated with ZnO,

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

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11. Give reasons :

(i) Conc. HNO_3 can be transported in aluminium container.

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

(iii) Graphite is used as lubricant.

(iv) Diamond is used as an abrasive.

(v) Aluminium alloys are used to make aircraft body.

(vi) Aluminium utensils should not be kept in water overnight.

(vii) Aluminium wire is used to make transmission cables.

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

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

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14. What are allotropes? Sketch the structure of two allotropes of carbon namely diamond and graphite. What is the impact of structure on physical properties of two allotropes?

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15. a. Classify following oxides as neutral, acidic, basic or amphoteric: CO, B_2O_3, SiO_2, CO_2, Al_2O_3, PbO_2, Tl_2O_3.

b. Write suitable chemical reaction to show their nature.

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

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

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

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19. A certain salt X gives the following results:

(i) Its aqueous solution is alkaline to litmus.

(ii) It swells up to a galssy material Y on strong heating.

(iii) When conc. H_2SO_4 is added to a hot solution of X, white crstals of an acid Z separate out.

Write equations for all the above reactions and identify x,y and Z.

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20. Write balanced equations for the following:

(i) $BF_3 + LiH \rightarrow$ (ii) $B_2H_6 + H_2O \rightarrow$ (iii) $NaH + B_2H_6 \rightarrow$

(iv) $H_3BO_3 \rightarrow$ (v) $Al + NaOH \rightarrow$ (vi) $B_2H_6 + NH_3 \rightarrow$

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

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22. Aqueous solution of $AlCl_3$is

(A) acidic

(B) basic

(C) amphoteric

(D) None of these

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23. Boric acid is polymeric due to

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

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

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24. The type of hybridisation of boron in diborane is

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

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25. Thermodynamically the most stable form of carbon is

(a) diamond , (b) graphite

(c) fullerenes , (d) coal

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26. Elements of group 14

(a) exhibit oxidation state of +4 only

(b) exhibit oxidation state of +2 and +4

(c) form M^{2-} and M^{4+} ions

(d) form M^{2+} and M^{4+} ions

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

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Ncert Questions And Exercises With Answers Ncert Exercises

1. Discuss the pattern of variation in the oxidation states of (a)$B \to TI$ and (b) $C \to Pb$.

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2. How can you explain higher stability of BCI_3 as compared to $TICI_3$?

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

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

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5. Is boric acid a protic acid? Explain.

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6. Explain what happens when boric acid is heated.

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7. Describe the shapes of BF_3 and $BH_4^{\ominus}$. Assign the hybridisation of boron in these species.

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8. Write reaction of justify amphoteric nature of aluminium.

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

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10. Write the resonance structure of CO_3^{2-} and $HCO_3^{\ominus}$.

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

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

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13. Rationalise the given statements and give chemical reactions.

a. Lead(II) chloride does not react with Cl_2 to give $PbCl_4$.

b. Lead(IV) chloride is highly unstable towards heat.

c. Lead is known not to form an iodide, Pbl_4.

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

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15. If $B - Cl$ bond has a dipole moment, explain why BCl_3 molecule has zero dipole moment.

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16. AlF_3 is insoluble in anhydrous HF but dissolves on addition of NaF. AlF_3 precipitates out of the resulting solution when gaseous BF_3 is bubbled through. Give reasons.

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17. Suggest a reason as to why CO is poisonous.

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

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19. Explain structures of diborane and boric acid.

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Ncert Exemplar Problems With Answer Hints And Solutions Multiple Choice Question I

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. $AlCl_3$

B. $MgCl_2$

C. $CaCl_2$

D. $BaCl_2$

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.

A. sp^3, tetrahedral

B. sp^3 square planar

C. sp^3d^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 co-ordination 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

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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 :

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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

A. $MeSiCl_3$

B. Me_2SiCl_2

C. Me_3SiCl

D. Me_4Si

Answer: C

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9. Ionisation enthalpy $\left(\Delta_i H \text{ kJ mol}^{-1}\right)$ for the elements of group 13 follows the order.

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10. In the structure of diborane

A. All hydrogen atoms 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 same plane and 2 bridging hydrogen atoms lie in the perpendicular plane

C. 4 bridging hydrogen atoms and boron atoms life in one plne 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.

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

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13. The most commonly used reducing agent is ----------

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14. Dry ice is

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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

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Ncert Exemplar Problems With Answer Hints And Solutions Multiple Choice Question Ii

1. The reason for small radius of Ga compared to Al is .....

A. poor screening effect of d and f orbitals

B. increases in nuclear charge

C. presence of higher orbitals

D. higher atomic number

Answer: A::B

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2. The linear shape of CO_2 is due to .....

A. sp^3 hybridisation of carbon

B. sp hybridisation of carbon

C. $p\pi - p\pi$ bonding between carbon and oxygen

D. sp^2 hybridisation of carbon

Answer: B::C

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3. $MeSiCl$ is used during polymerisation of organo silicones because

A. the chain lengths of organosilicone polymers can be controlled by adding Me_3SiCl

B. Me_3SiCl blocks the end terminal of silicone polymer

C. Me_3SiCl improves the quality and yield of the polymer

D. Me_3SiCl acts as a catalyst during polymeriation

Answer: A::B

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4. Which of the following statements are correct ?

A. Fullerenes have dangling bonds

B. Fullerenes are cage-like molecules

C. Graphite is thermodynamically most stable allotrope of carbon

D. Graphite is slippery and hard and therefore used as a dry lubriant in machines

Answer: B::C

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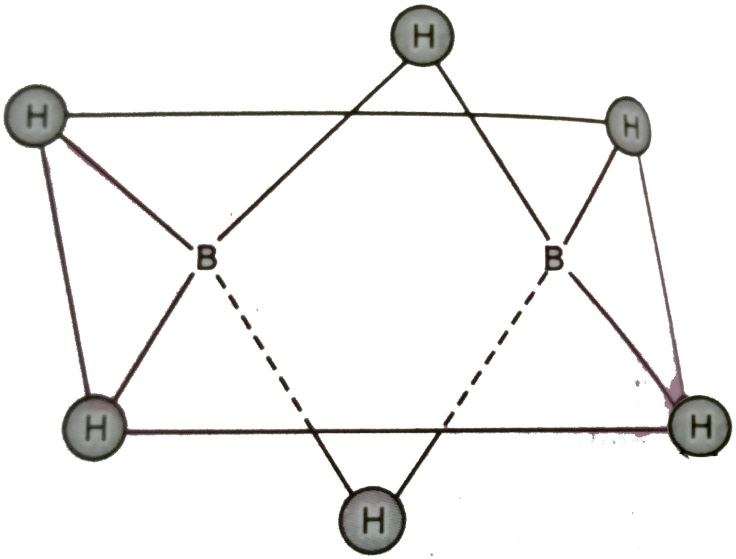
5. Which of the following statements are correct ? Answer on the basis of figure.



A. The two bridged hydrogen atom and the boron atoms lie in one plane

B. Out of six $B-H$ bonds two bonds can described in terms of 3 centre 2-electrons

C. Out of six B-H bonds four B-H bonds can described in terms of 3 centre 2 electrons

D. The four terminal B-H bonds are two centre-two electrons regular bonds.

Answer: A::B::D

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6. Identify the correct resonance structures of carbon dioxide from the one given below:

A. $O - C \equiv O$

B. $O = C = O$

C. $.^{-} O \equiv C - O^{+}$

D. $.^{-} O - C \equiv O^{+}$

Answer: B::D

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Ncert Exemplar Problems With Answer Hints And Solutions Short Answer Questions

1. Draw the structure of BCl_3. NH_3 and $AlCl_3$ (dimer).

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2. Explain the nature of boric acid as a Lewis acid in water.

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3. Draw the structure of boric acid showing hydrogen bonding. Which species is present in water ? What is the hybridisation of boron in this species ?

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4. Explain why the following compound behave as Lewis acids ? (i) BCl_3, (ii) $AlCl_3$

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5. Give reasons for the following

(a) CCl_4 is immiscible in water, whereas $SiCl_4$ is easily hydrolysed.

(b) Carbon has a strong tendency for catenation compared to silicon.

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6. Explain the following

(a) CO_2 is a gas whereas SiO_2 is a solid

(b) Silicon forms SiF_6^{2-} ion whereas corresponding fluoro compound of carbon is not known.

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7. The +1 oxidation state in group 13 and +2 oxidation state in group 14 becomes more and more stable with increased atomic number. Explain.

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8. Carbon and silicon both belong to the group 14, but inspite of the stoichiometric similarity, the dioxides, (i.e., carbon dioxide and silicon dioxide), differ in their structures. Comment.

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9. If a trivalent atom replaces a few silicon atoms in three dimensional network of silicon dioxide, what would be the type of charge on overall structure ?

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10. When BCl_3 is treated with water, it hydrolyses and forms $\left[B(OH)_4\right]^-$ only whereas $AlCl_3$ in acidified aqueous solution forms $\left[Al(H_2O)_6\right]^{3+}$ ion, Explain what is the hybridisation of boron and aluminium in these species?

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11. Aluminium dissovles in mineral acids and aqueous alkalies and thus shows amphoteric character. A place of aluminum foil is treated with dilute hydrochloric acid or dilute sodium hydroxide solution in a test tube and on bringing a burning match stick near the mouth of the test tube, a pop sound indicates the evolution of hydrogen gas. The same activity when performed with concentrated with concentrated nitric acid. reaction doesn't proceed. Expalin the reason.

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12. Explain the following : (i) Gallium has higher ionisation enthalpy than aluminium.

(ii) Boron does not exists as B^{3+} ion.

(iii) Aluminium forms $[AlF_6]^{3-}$ ion but boron does not form $[BF_6]^{3-}$ ion.

(iv) PbX_2 is more stable than PbX_4.

(v) Pb^{4+} acts as an oxidising agent but Sn^{2+} acts as a reducing agent.

(vi) Electron gain enthalpy of chlorine is more negative as compared to fluorine.

(vii) $Tl(NO_3)_3$ acts as an oxidising agent.

(viii) Carbon shows catenation property but lead does not.

(ix) BF_3 does not hydrolyse completely (modified).

(x) Why does the elemnet silicon, not form a graphite like structure whereas carbon does.

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13. Identify the compound A, X and Z in the following reactions:

(i) $A + 2HCl + 5H_2O \rightarrow 2NaCl + x$ (ii) $X \xrightarrow[370k]{\Delta} HBO_2 \xrightarrow[>370k]{\Delta} Z$

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14. Complete the following chemical equations :

$Z + 3LiAlH_4 \rightarrow X + 3LiF + 3AlF_3 : X + 6H_2O \rightarrow Y + 6H_2$

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Ncert Exemplar Problems With Answer Hints And Solutions Matching Type Questions

1. Match the species given in Column I with the properties mentioned in Column II

	Column-I		Column-II
A.	BF_4^-	1.	Oxidation state of central atom is +4
B.	$AlCl_3$	2.	Strong oxidising agent
C.	SnO	3.	Lewis acid
D.	PbO_2	4.	Can be further oxidised
		5.	Tetrahedral shape

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2. Match the species given in Column I with properties given in Column II

	Column-I		Column-II
A.	Diborane	1.	Used as a flux for soldering metals
B.	Gallium	2.	Crystalline form of silica
C.	Borax	3.	Banana bonds
D.	Aluminossilicate	4.	Low melting, high boiling, useful for measuring
E.	Quartz	5.	Used as catalyst in petrochemical industries

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3. Match the species given in Column I with hybridisation given in Column II.

Column-I	Column-II
A. Boron in $[B(OH_4)]^-$	1. sp^2
B. Aluminium in $\left[Al(H_2O)_6\right]^{3+}$	2. sp^3
C. Boron in B_2H_6	3. sp^3d^2
D. Carbon in buckminster fullerene	
E. Silicon in SiO_4^{4-}	
F. Germanium in $[GeCl_6]^{2-}$	

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Ncert Exemplar Problems With Answer Hints And Solutions Assertion And Reason Type Questions

1. Assertion (A): If aluminium atom s replace a few silicon atoms in three dimensional network of silicon dioxide, the overall structure acquries a negative charge.

Reason(R): Aluminium is trivalent while silicon is tetravalent.

A. Both A and R are correct and R is the correct explanation of A.

B. Both A and R are correct and R is not the correct explanation of A.

C. Both A and R are not correct.

D. A is not correct but R is correct.

Answer: A::C

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2. Assertion (A) : Silicons are water repelling in nature.

Reason (R) : Silicons are organosilicon polymers, which have $(- R_2SiO -)$ as repeating unit.

A. Both A and R are correct and R is the correct explanation of A.

B. Both A and R are correct and R is not the correct explanation of A.

C. Both A and R are not correct.

D. A is not correct but R is correct.

Answer: A::B::C::D

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Ncert Exemplar Problems With Answer Hints And Solutions Long Answer Questions

1. Account for the following observations

(a) $AlCl_3$ is a Lewis acid

(b) Though fluorine is more electronegative than chlorine yet BF_3 is a weaker Lewis acid than CI_3

(c) PbO_2 is a stronger oxidising agent than SnO_2

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

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2. When aqueous solution of borax is acidified with hydrochloric acid, a white crystalline solid is formed which is soapy to touch, is this solid acidic or basic in nature? Explain.

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3. Three pairs of compounds are given below, identify that compound in each of the pairs which has group 13 element in more stable oxidation state. Give reason for your choice.

(i) $TlCl_3$. $TlCl$ (ii) $AlCl_3$. $AlCl$ (iii) $InCl_3$. $InCl$

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4. BCl_3 exists as monomer whereas $AlCl_3$ is dimerised through halogen bridging. Give reason, Explain the structre of the dimer of $AlCl_3$ also.

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5. Boron fluoride exists as BF_3 but boron hydride does't exist as BH_3. Give reason. In which form does it exist ? Explain its structure.

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6. (a) What are silicones ? States the uses of silicones

(b) What are boranes ? Give chemical equation for the preparation of diborane.

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7. A compound (A) of boron reacts with Nme_3 to give an adduct (B) which on hydrolysis gives a compound (C) and hydrogen gas. Compound (C) is an acid. Identify the compounds A,B and C. give the reactions inovolved.

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8. A non-metallic element of group 13, used in making bullet prrof vests is extremely hard solid of black colour. It can exist in many allotroic forms and has unusally high melting point. Its trifluoride acts as Lewis acid towards ammonia. The element exhibits maximum covalency of four. Identify the element and write the reaction of tits triffuoride with ammonia. Explain why does the trifuoride act as Lewis acid.

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9. A tetravalent element forms monoxide and dioxide with oxygen. When air is passed over heated element (1273k), producer gas is obtained. Monoxide of the element is a powerful reducing agent and reduces ferric oxide to iron. Identify the element and write formulas of its monoxide and dioxide. write chemical equations for the formation of producer gas and reduction of ferric oxide with the monoxide.

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Additional Questions Very Short Answer Questions I Group 13 Elements

1. INERT PAIR EFFECT

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2. Why the elements of second row (first short period) show a number of differences in properties from other members of their respective families ?

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3. Which element of group 13 forms the most stable $+1$ oxidation state.

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4. Name the element of group 13 which forms only covalent compounds.

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5. Why boron compounds such as BF_3 are called electron deficient compounds ?

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6. Why boron trihalides act as Lewis acids ?

Watch Video Solution

7. BCl_3 behaves as a Lewis acid Give reason.

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8. How does electron deficient compound BF_3 achieve electron saturation, i.e. fully occupied outer electronic shells?

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9. Why do boron halides form addition compounds with amines ?

Watch Video Solution

10. Why BF_3 forms as an adduct with ammonia ?

Watch Video Solution

11. Which element of group 13 forms amphotric hydroxide ?

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12. How does BF_3 act as a catalyst in industrial process?

Watch Video Solution

13. Draw the structure of Al_2Cl_6.

Watch Video Solution

14. What is the correct strctural formula of borax $(Na_2B_4O_7.10H_2O)$

Watch Video Solution

15. What happens when : (i) Carbon dioxide is passed through an aqueous solution of sodium metaborate.

(ii) Boric acid is heated with ethyl alcohol in presence of concentrated sulphuric acid.

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16. What happens when a borax solution is acidfied ? Write a balanced equation for the reaction.

Watch Video Solution

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

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18. What happens when boric acid is heated?

Watch Video Solution

19. What are boranes?

Watch Video Solution

20. How is diborane prepared ?

Watch Video Solution

21. How does $NaBH_4$ react with iodine ?

Watch Video Solution

22. How is inorganic benzene prepared ?

Watch Video Solution

23. Draw the structure of B_2H_6.

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Additional Questions Very Short Answer Questions Ii Group 14 Elements

1. What is the general valence shell electronic configuration of group 14 elements?

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2. Which out of carbon and silicon forms multiple bonds?

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3. Explain why silicon shows a higher covalency than carbon.

Watch Video Solution

4. Out of CCl_4 and $SiCl_4$ which one reacts with water?

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5. What is catenation ?

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6. Which element of group 14 exhibits maximum tendency for catenation ?

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7. Why are carbon compounds relatively inert ?

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8. $(CH_3)_3N$ is basic but $(CF_3)_3N$ is not basic. Explain why ?

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9. Why is diamond a bad conductor of electricity but a good conductor of heat?

Watch Video Solution

10. What is dry ice? Why is it so called?

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11. Carbon dioxide is passed through a suspension of powdered limestone in water. Write balanced chemical equation for the above reaction.

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12. Which oxide of carbon is an anhydride of carbonic acid?

Watch Video Solution

13. What is water gas? How it is prepared?

Watch Video Solution

14. Complete the following reaction equation, $R_2SiCl_2 + H_2O \rightarrow$

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15. Mention an industrial application of silicones.

Watch Video Solution

16. Which is the basic building unit of all sillicates?

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Additional Questions Short Answer Questions I Group 13 Elements

1. To which block of the periodic table group 13 belongs.What is the general outer electronic configuration of this group?

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2. Explain maximum covalency of boron and aluminium.

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3. How does boron occur ?

Watch Video Solution

4. Name the elements of group 13 in the increasing order of their atomic numbers and write their electronic configurations.

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5. What is inert pair effect ? Discuss the oxidation states of Group 13 elements in the light of inert pair effect .

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6. Boron is trivalent. Explain.

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7. Give the structure of anhydrous aluminium chloride and boron trifluoride.

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8. Boron forms no compound in unipositive state while thallium in unipositive state is stable. Explain.

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9. Why boron forms electron deficient compounds?

Watch Video Solution

10. Write balanced equations for the reaction of elemental boron with oxygen and nitrogen ?

Watch Video Solution

11. Discuss the acid-base behaviour of oxides and hydroxides of group 13 elements .

Watch Video Solution

12. What happens when aluminium reacts with : (i) $NaOH$ and (ii) Conc. HNO_3 ?

Watch Video Solution

13. How are boron trihalides prepared ?

Watch Video Solution

14. Discuss the structure of boron trihalides.

Watch Video Solution

Watch Video Solution

15. Why do boron trihalides behave as Lewis acids ? Discuss their relative acid strength .

Watch Video Solution

16. Describe the shapes of BF_3 and $BH_4^{\ominus}$. Assign the hybridisation of boron in these species.

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17. Explain the following giving reason : (i) BF_3 acts as a Lewis acid.

(ii) BF_3 is a weaker acid than BCl_3.

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18. Arrange the boron trihalides in order of increasing Lewis acid character.

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19. Comment upon icosahedral structure of boron.

Watch Video Solution

20. Why does boron differ from rest of the elements of group ? Give at least three points of difference.

Watch Video Solution

21. Discuss briefly the action of heat or borax.

Watch Video Solution

22. Discuss the structure of $\left[B_4O_5(OH)_4\right]^{2-}$.

Watch Video Solution

23. Explain the chemistry of borox bead test.

Watch Video Solution

24. How is boric acid prepared from borax ? Briefly discuss its acidic nature.

Watch Video Solution

25. Discuss the action of heat on boric acid .

Watch Video Solution

26. How is borate ion detected in qualitative analysis ?

Watch Video Solution

27. Comment upon the structure of boric acid .

Watch Video Solution

28. How is diborane prepared in the laboratory ? Discuss its structure.

Watch Video Solution

29. How is inorganic benzene prepared ? Why is it called so ?

Watch Video Solution

30. Complete and balance the following chemical equations.

(i) $BF_3 + (CH_3)_3N(\text{or}Me_3N) \rightarrow$

(ii) $BCl_3 + H_2O \rightarrow$

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31. Give the composition and uses of the following alloys.

(i) Aluminium boronze , (ii) Magnalium , (iii) Duralumin

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32. List some uses of boron and its compounds.

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Additional Questions Short Answer Questions Ii Group 14 Elements

1. Name the elements present in group 14. What is their general valence configuration ?

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2. Account for the following : (i) C and Si are tetravalent but Ge, Sn and Pb show divalency.

(ii) CCl_4 is resistant to hydrolysis.

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3. $PbCl_4$ is less stable than $SnCl_4$ but $PbCl_2$ is more stable than $SnCl_2$. Justify.

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4. Give two characteristic differences between C and Si based on the absence of d-orbitals in its valence shell.

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5. What is catenation ? How does catenation vary in the 14th group ?

Watch Video Solution

6. What is catenation ? How does it explain huge number of carbon compounds.

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7. What is allotropy ? Name two elements which exhibit allotrophy.

Watch Video Solution

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

Watch Video Solution

9. Account for the following : (i) Diamond is hard but graphite is soft .

(ii) Graphite is used in jewellary

(iii) Graphite is used as a lubricant but diamond is used as an abrasive.

Watch Video Solution

10. What are fullerenes ? How are they prepared ? Discuss their structure.

Watch Video Solution

11. What is dry ice ? Why is it so called ? Give its one use.

Watch Video Solution

12. Account for the toxic nature of carbon monoxides.

Watch Video Solution

13. Write equations for the produciton of water gas producer gas from coke.

Watch Video Solution

14. Explain the following : (i) Carbon dioxide turns lime water milky. But if passed for a long time, the solution becomes clear again.

(ii) CO_2 is a gas but SiO_2 is a solid.

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15. What are silicons ? How are they manufactured ?

Watch Video Solution

Watch Video Solution

16. Write the structure of the product of hydrolysis of $(CH_3)_2SiCl_2$ and its two uses.

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Additional Questions Long Answer Questions

1. Discuss briefly the trends in the acid-base character of oxidees and halides of group 13 elements.

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2. Give the preparation of borax from the mineral colemanite. Briefly describe its properties and uses.

Watch Video Solution

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

Watch Video Solution

4. Name two oxides of carbon. Discuss briefly their preparation , properties and uses.

Watch Video Solution

5. How is silicon tetrachloride prepared ? Discuss its important properties and uses.

Watch Video Solution

6. What are silicones ? How are they prepared ? What are their uses.

Watch Video Solution

7. Write short notes on : (i) Silicates

(ii) Zeolites

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Analytical Questions And Problems With Answer Solution

1. Gallium lies below aluminium in group 13 of the periodic table but its atomic radius is smaller than that of aluminium. Why so ?

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2. Gallium has much higher atomic number than aluminium yet its atomic radius is lower than that of aluminium. Justify.

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3. Although thallium (Z = 81) has only slightly higher atomic radius (170 pm) than that of indium (167 pm) but its ionization enthalpy $\left(589kJmol^{-1}\right)$ is much higher than that of indium $\left(558kJmol^{-1}\right)$. Explain why ?

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4. Do you think that anhydrous and hydrous aluminium chloride will have different solubilities is diethyl either ? Comment .

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5. Do $(CH_3)_3N$ and $(Me_3Si)_3N$ have similar structure ? Justify your answer .

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6. Why $N(CH_3)_3$ is more basic than $(Me_3Si)_3N$? Why so ?

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7. BF_3 exists as discrete molecules but BH_3 exists as dimer. Explain .

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8. Unlike ordinary fire, thermite reaction cannot be stopped by pouring water. Explain.

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9. CCl_4 does not reach with water but $SiCl_4$ does . Why so ?

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10. Aluminium forms AlF_6^{3-} but boron does not form BF_6^{3-}. Why so ?

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11. Silicon forms $[SiF_6]^{2-}$ but not $[SiCl_6]^{2-}$. Explain the possible reason.

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12. AlF_3 dissolves in NaF but not in anhydrous HF. Explain why.

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13. Carbon and silicon both belong to the group 14, but inspite of the stoichiometric similarity, the dioxides, (i.e., carbon dioxide and silicon dioxide), differ in their structures. Comment.

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14. If a trivalent atom replaces a few silicon atoms in three dimensional network of silicon dioxide, what would be the type of charge on overall structure ?

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Analytical Questions And Problems With Answer Solution Problems

1. 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 boron trioxide. Identify X and Y. Give balanced equations involved in the formation of Y and its reaction with air. Drew the structure of Y.

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2. Starting from $SiCl_4$ prepare the following in steps not exceeding the number give in parantheses (give reaction only)

a. Silicon (1)

b. Linear silicon containing methyl groups only (4)

c. $Na_2SiO_3(3)$.

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3. For a mineral . $liAl(SiO_3)_2$, what is the charge on SiO_3 unit ? What is the arrangement of oxygen atoms around the silicon atom ?

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Competition Focus Jee Main And Advanced Medical Entrance 1 Multiple Choice Questions I Group 13 Elements

1. Corundum is . . . . . mineral of aluminium

A. silicate

B. oxide

C. double salt

D. sulphate

Answer: B

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2. Which is the following metallic oxides exhibit amphoteric nature ?

A. BaO

B. Al_2O_3

C. Na_2O

D. CaO

Answer: B

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3. Boron cannot from which one of the following anions?

A. BF_6^{3-}

B. BH_4^-

C. $B(OH)_4^-$

D. BO_2^-

Answer: A

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4. Which one of following elements is unable to from MF_6^{3-} ion?

A. Ga

B. Al

C. B

D. In

Answer: C

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5. Predict the correct shape of BH_4^-

A. Pyramidal, sp^3

B. octahedral, sp^3d^2

C. tetrahedral, sp^3

D. none of the above

Answer: C

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6. Which of the following pairs has almost same radii ?

A. Al, Ga

B. Be, Mg

C. Mg, Cl

D. B, Be

Answer: A

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7. The increasing order of atomic radii of the following group 13 elements is

A. $Al < Ga < In < Tl$

B. $Ga < Al < In < Tl$

C. $Al < In < Ga < Tl$

D. $Al < Ga < Tl < In$

Answer: B

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8. The correct order of atomic radii in group 13 elements is

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

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

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

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

Answer: D

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9. The stability of $+1$ oxidation state among Al, Ga, In and Tl increases in the sequence :

A. $Al < Ga < In < Tl$

B. $Tl < In < Ga < Al$

C. $In < Tl < Ga < Al$

D. $Ga < In < Al < Tl$

Answer: A

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10. The +1 oxidation state of thallium is more stable than its +3 oxidation state because of

A. its atomic size

B. its ionization potential

C. inert pair effect

D. diagonal relationship

Answer: C

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11. The ion(s) that act/s as oxidizing agent in solution is/are

A. Tl^{+} and Al^{3+}

B. B^{3+} and Al^{3+}

C. Tl^{3+} only

D. B^{3+} only

Answer: C

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12. For BCl_3, $AlCl_3$ and $GaCl_3$ the increasing order of ionic character is

A. $BCl_3 < AlCl_3 < GaCl_3$

B. $GaCl_3 < AlCl_3 < BCl_3$

C. $BCl_3 < GaCl_3 < AlCl_3$

D. $AlCl_3 < BCl_3 < GaCl_3$

Answer: C

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13. For the properties mentioned, the correct trend for the different species is in

A. strength as Lewis acids -

$$BCl_3 > AlCl_3 > GaCl_3$$

B. inert pair effect - $Al > Ga > In$

C. oxidising property $- Al^{3+} > Ga > In$

D. first ionization enthalpy $- B > Al > Tl$

Answer: A

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14. Which of the following is similar to graphite ?

A. B_4C

B. B_2C

C. BN

D. B

Answer: C

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15. Which of the following is known as inorganic graphite?

A. B

B. B_4C

C. B_2H_6

D. BN

Answer: D

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16. Heating an aqueous solution of aluminium chloride to dryness will give

A. $AlCl_3$

B. Al_2Cl_6

C. Al_2O_3

D. $Al(OH)Cl_2$

Answer: C

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17. Al_2O_3 becomes anhydrous $AlCl_3$ upon heating

A. with $NaCl$

B. with dry Cl_2 and C

C. with Cl_2

D. with dry HCl gas

Answer: B

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18. Conc. HNO_3 can be stored in a container made of

A. Cu

B. Zn

C. Al

D. $Sn.$

Answer: C

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19. Which of the following statement is incorrect?

A. Pure sodium metal dissolves in liquid ammonia to give blue soluion

B. NaOH reacts with glass to give sodium silicate

C. Aluminium reacts with excess $NaOH$ to give $Al(OH)_3$

D. $NaHCO_3$ in heating gives Na_2CO_3

Answer: C

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20. When metal 'M' is treated with $NaOH$, a white gelatinous precipitate 'X' is obtained which is soluble in excess of NaOH. Compound 'X' when heated strongly gives an oxide which is used in chromatography as an adsorbent. Then metal 'M'

A. Zn

B. Ca

C. Al

D. Fe

Answer: C

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21. AlF_3 soluble in HF only in presence of KF. It is due to the formation of

A. $K_3[AlF_3H_3]$

B. $K_3[AlF_6]$

C. AlH_3

D. $Kl[AlF_3H]$

Answer: B

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22. The tendency of BF_3, BCl_3 and BBr_3 behave as Lewis acid decreases in the sequnece

A. $BF_3 < BCl_3 > BBr_3$

B. $BCl_3 > BF_3 > BBr_3$

C. $BBr_3 > BCl_3 > BF_3$

D. $BBr_3 > BF_3 > BCl_3$

Answer: C

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23. Which one of the following has highest Lewis acid strength ?

A. BI_3

B. BBr_3

C. B_3

D. BCl_3

Answer: A

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24. the correct statement is

A. BI_3 is the weakest Lewis acid among the boron halides

B. there is minimum $p\pi - p\pi$ back bonding in BF_3

C. BF_3 is the strongest Lewis acid among the other boron halides

D. there is maximum $p\pi - p\pi$ back bonding in BF_3.

Answer: D

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25. Which of the following are Lewis acids?

A. PH_3 and BCl_3

B. $AlCl_3$ and $SiCl_4$

C. PH_3 and $SiCl_4$

D. BCl_3 and $AlCl_3$

Answer: D

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26. Which of the following is a Lewis acid ?

A. NaH

B. NF_3

C. PH_3

D. $B(CH_3)_3$

Answer: D

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27. The bond dissociation energy of $B-F$ in BF_3 is $646\,\mathrm{kJ\,mol^{-1}}$ whereas that of $C-F$ in CF_4 is $515\,\mathrm{kJ\,mol^{-1}}$. The correct reason for higher $B-F$ bond dissociation energy as compared to that of $C-F$ 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-atom as compared to that of C-atom

Answer: B

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28. The correct formula of borax is

A. $Na_2\left[B_4O_4(OH)_3\right].9H_2O$

B. $Na_2\left[B_4O_5(OH)_4\right].8H_2O$

C. $Na_2\left[B_4O_6(OH)_5\right].7H_2O$

D. $Na_2\left[B_4O_7(OH)_6\right].6H_2O$

Answer: B

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29. In borax the number of B-O-B links and B-OH bond present are, respectively.

A. five and four

B. four and five

C. three and four

D. five and five

Answer: A

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30. $2B(OH)_3 + 2NaOH \Leftrightarrow NaBO_2 + Na\left[B(OH)_4\right] + 2H_2O$

How can this reaction be made to proceed in forwards direction ?

A. addition of cis-1, 2-diol

B. addition of borax

C. addition of trans-1, 2-diol

D. addition of Na_2HPO_4

Answer: A

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31. Boric acid is an acid because its molecule

A. contains replacement H^+ ion

B. gives up a proton

C. accepts OH^- from water releasing proton

D. combines with proton from water molecule

Answer: C

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32. On the addition of mineral acid to an aqueous solution of borax, the compound formed is:

A. boron hydride

B. pyroboric acid

C. metaboric acid

D. orthoboric acid

Answer: D

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33. The type of hybridization of boron in diborane is

A. sp-hybridization

B. sp^2-hybridization

C. sp^3-hybridization

D. sp^3d^2-hybridization

Answer: C

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34. The structure of diborane (B_2H_6) contains :

A. four $2c-2e$ bonds and two $3c-2e$ bonds

B. two $2c-2e$ bonds and four $3c-2e$ bonds

C. two $2c-2e$ bonds and four $3c-3e$ bonds

D. four $2c-2e$ bonds and four $3c-2e$ bonds

Answer: A

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35. In diborane, the number of electrons that account for bonding in the bridges is

A. six

B. two

C. eight

D. four

Answer: D

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36. Three centred two electron bond is present in

A. NH_3

B. B_2H_6

C. BCl_3

D. $AlCl_3$

Answer: B

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37. Reaction of diborane with ammonia gives initially

A. $B_2H_6.\ NH_3$

B. Borazole

C. $B_2H_6.3NH_3$

D. $\left[BH_2(NH_3)_2\right]^+[BH_4]^-$

Answer: D

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38. The number of isomers possible for disubstituted borazine, $B_3N_3H_4X_2$ is

A. 3

B. 4

C. 5

D. 2

Answer: B

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39. The prdouct/s formed when diborane is hydrolysed is/are

A. B_2O_3 and H_3BO_3

B. B_2O_3 only

C. H_3BO_3 and H_2

D. H_3BO_3 only

Answer: C

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40. An alkali metal hydride (NaH) reacts with diborane is 'A' to give a tetrahedral compound 'B' which is extensilve used as reducing agent in organic synthesis. The compoun d 'A' and'B' respectively. Are

A. CH_3COCH_3 and $B_3N_3H_6$

B. $(C_2H_5)_2O$ and $NaBH_4$

C. C_2H_6 and C_2H_5Na

D. C_6H_6 and $NaBH_4$

Answer: B

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41. What is the structural formula of lithium tetrahydrido aluminate

A. $Al[LiH_4]$

B. $Al_2[LiH_4]_3$

C. $Li[AlH_4]$

D. $Li[AlH_4]_2$

Answer: C

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42. Which one of the following is the correrct statement ?

A. $B_2H_6.2NH_3$ is known as 'inorganic benzen'

B. Boric acid is a protonic acid.

C. Beryllium exhibits coordinates number of six.

D. Chlorides of both coordinates and aluminium have bridged chlorine structure in solid phase.

Answer: D

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43. The compound that is used in nuclear industry as protective shields and control rods is

A. metal carbonates

B. metal chlorides

C. metal oxides

D. metal borides

Answer: D

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Competition Focus Jee Main And Advanced Medical Entrance 1 Multiple Choice Questions Ii Group 14 Elements

1. Which of the following oxidation states are the most characteristics for lead and tin, respectively?

A. $+2,\ +2$

B. $+4,\ +2$

C. $+2,\ +4$

D. $+4,\ +4$

Answer: C

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

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

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

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

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

Answer: D

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

A. $PbX_2 < < SnX_2 < < GeX_2 < < SiX_2$

B. $GeX_2 < < SiX_2 < < SnX_2 < < PbX_2$

C. $SiX_2 < < GeX_2 < < PbX_2 < < SnX_2$

D. $SiX_2 < < GeX_2 < < SaX_2 < < PbX_2$

Answer: D

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4. Which of the following oxides is not expected to react with sodium hydroxide ?

A. CaO

B. SiO

C. BeO

D. B_2O_3

Answer: A

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5. In which of the following arrangements the given sequence is not strict according to the property indicated against it?

A. $HF < HCl < HBr < HI$: increasing acidie strength

B. $H_2O < H_2S < H_2Se < H_2Te$: increasing pK_a values

C. $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing acidic character

D. $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

Answer: B

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6. Supercritical CO_2 is used as

A. dry ice

B. fire fighting

C. a solvent for extraction of organic compounds from natural sources

D. a highy inert medium for carrying out various reations

Answer: C

Watch Video Solution

7. which of the following oxide is amphoteric ?

A. SnO_2

B. CaO

C. SiO_2

D. CO_2

Answer: A

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8. Water transpoted through Lead pipes becomes poisonous due to the formation of :

A. $Pb(OH)_2$

B. PbO

C. PbO_2

D. Pb_3O_4

Answer: A

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9. Litharge is chemically

A. PbO

B. PbO_2

C. Pb_3O_4

D. $Pb(CH_3COO)_2$

Answer: A

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10. When PbO_2 reacts with conc. HNO_3 the gas evolved is

A. NO_2

B. O_2

C. N_2

D. N_2O

Answer: B

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11. When formic acid is heated with concentrated H_2SO_4, the gas evolved is

A. H_2S

B. SO_2

C. CO

D. CO_2

Answer: C

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12. Among the following the maximum covalent character is shown by the compound

A. $SnCl_2$

B. $AlCl_3$ and $SiCl_4$

C. $MgCl_2$

D. $FeCl_2$

Answer: B

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13. $PbCl_2$ is insoluble in cold water. Addition of HCl increases its solubility due to

A. formation of soluble complex anions like $[PbCl_3]^-$

B. oxidation of $Pb(II)$ to $Pb(IV)$

C. formation of $\left[Pb(H_2O)_6\right]^{2+}$

D. formation of polymeric lead complexes

Answer: A

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14. Soldiers of Napolean army while at alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White metallic tin buttons got converted to grey powder. This transformation is related to

A. an interaction with nitrogen of the air at very low temperatures

B. a change in the crystallines structure of tin.

C. a change iin the partial pressure of oxygen in the air.

D. an interaction with water vapour contained in the humid air.

Answer: B

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15. The lead of lead pencils melts at

A. $2000^\circ C$

B. $350^\circ C$

C. $3170^\circ C$

D. $75^\circ C$

Answer: C

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16. Which one of the following allotropic forms of carbon is isomorphous with crystalline silicon?

A. Graphite

B. Coal

C. Coke

D. Diamond

Answer: D

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17. The hybridisation of C in diamond , graphite and ethyne in order _____.

A. sp^3, sp, sp^2

B. sp^3, sp^2, sp

C. sp, sp^2, sp^3

D. sp^2, sp^3, sp

Answer: B

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18. In graphite and diamond, the percentage of p-characters of the hybrid orbitals in hybridisation are respectively:

A. 33 and 75

B. 50 and 75

C. 33 and 25

D. 67 and 75

Answer: D

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19. The repeating structural unit of silicone is

A. SiO_2

B. $-\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{Si}}-O-$

C. $\underset{\underset{R}{|}}{\overset{\overset{R}{|}}{O}}-Si-O-$

D. $-\underset{\underset{R}{|}}{\overset{|}{S}}-O-O-R$

Answer: B

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20. The straight chain polymer is formed by

A. hydrolysis of $(CH_3)_4SiCl_3$ by addition condensation polymerisation

B. hydrolysis of $(CH_3)_4Si$ by addition polymerisation

C. hydrolysis of $(CH_3)_2SiCl_2$ followed by condensation polymerisation

D. hydrolysis of $(CH_3)_3SiCl$ followed by condensation polymerisation

Answer: C

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21. Silicone oil is obtained from the hydrolysis and polymerization of

A. trimethychlorosilane and dimethyldichloro-silane

B. trimethylchlorosilane and methyltrichloro-silane

C. methyltrichlorosilance and dimethyldichloro-silane

D. triethylchlorosilance and diethyldichlorosilance

Answer: A

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22. Under hydrolytic conditions , the compounds used for preparation of liner polymer and for chain termination respectively are .

A. CH_3SiCl_3 and $Si(CH_3)_4$

B. $(CH_3)_2SiCl_2$ and $(CH_3)_3SiCl$

C. $(CH_3)_2SiCl_2$ and CH_3SiCl_3

D. $SiCl_4$ and $(CH_3)_3SiCl$

Answer: B

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23. Among the following substituted silanes, the one which will give rise to cross linkes silicons polymer on hydrolysis is

A. R_3SiCl

B. R_4Si

C. $RSiCl_3$

D. R_2SiCl_2

Answer: C

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24. $MeSiCl$ is used during polymerisation of organo silicones because

A. the chaing length of organosilicon polymers can be controlled by adding $(CH_3)_3SiCl$

B. $(CH_3)_3SiCl$ improves the quality and yields of the polymer

C. $(CH_3)_3SiCl$ does not block the end terminal of silicone polymer

D. $(CH_3)_3SiCl$ acts as a catalyst during polymerisation

Answer: A

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25. Which of these is not a monomer for a high-molecular mass silicone polymer?

A. Me_3SiCl

B. $PhSiCl_3$

C. $MeSiCl_3$

D. Me_2SiCl_2

Answer: A

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26. The basic structural unit of silicates is

A. SiO_3^{2-}

B. SiO_4^{2-}

C. SiO^-

D. SiO_4^{4-}

Answer: D

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27. Which of the following anions is present in the chain structure of silicates?

A. SiO_4^{4-}

B. $Si_2O_7^{6-}$

C. $\left(Si_2O_5^{2-}\right)_n$

D. $\left(SiO_3^{2-}\right)_n$

Answer: D

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28. Name the type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared

A. Linear chain silicate

B. Sheet silicate

C. Pyrosilicate

D. Three dimensional

Answer: C

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Competition Focus Jee Main And Advanced Medical Entrance Ii Multiple Choice Questions

1. Which of the following compounds (s) undergo disproportionation in aqueous solution ?

A. $TlCl_3$

B. $GaCl$

C. $InCl$

D. $TlCl$

Answer: B::C

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2. Which of the following are amphoteric oxides?

A. SnO_2

B. Al_2O_3

C. Ga_2O_3

D. SiO_2

Answer: A::B::C

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3. The option (s) with only amphoteric oxides is (are)

A. CrO_3, BeO, SnO, SnO_2

B. ZnO, Al_2O_3, PbO, PbO_2

C. NO, B_2O_3, PbO, SnO_2

D. Cr_2O_3, CrO, SnO, PbO

Answer: A::B

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4. Among the following, the correct statement(s) is(are) :

A. $Al(CH_3)_3$ has the three-centre two-electron bonds in its dimeric strucutres

B. BH_3 has the three-centre two-electrons bonds in its dimeric structure

C. the Lewis acidity of BCl_3 is greater than that of $AlCl_3$

D. $AlCl_3$ has the three-centre two-electron bonds in its dimeric structure.

Answer: A::B::C

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5. BF_3 is.

A. electron-deficient compounds

B. Lewis acid

C. used as rocket fuel

D. ionic compound.

Answer: A::B

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6. Select the most appropriate statemen. In BF_3

A. all the bonds are completely ionic

B. the B-F bond is partially ionic

C. B-F bond has partial double bond character

D. all the bonds are covalent

Answer: C::D

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7. The crystalline form of borax has

A. tetrabnuclear $\left[B_4O_5(OH)_4\right]^{2-}$ unit

B. all boron atoms in the same plane

C. equal number of sp^2 and sp^3 hybridized boron atoms

D. one terminal hydroxide per boron atom

Answer: A::C::D

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8. Boric acid is used in carrom boards for smooth gliding of pawns because

A. H_3BO_3 molecules are loosely chemically bonded and hence soft

B. its low density makes a fluffy

C. it can be powdered to a very small grain size

D. H-bonding in H_3BO_3 gives it a layered structure.

Answer: D

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9. The correct statement (s) for orthoboric acid is/are

A. it behaves as a weak acid in water due to self ionization

B. acidity of its aqueous solution increases upon addition of ethylene glycol

C. it has a three-dimensional structure due to hydrogen bonding

D. it is a weak electrolyte in water

Answer: B::D

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10. Which of the following species are not known ?

A. $[SiCl_6]^{2-}$

B. $[CF_6]^{2-}$

C. $[PbCl_6]^{2-}$

D. $[SiF_6]^{2-}$

Answer: A::B

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11. Which of the following are used as catalyst in Friedel-Crafts reactions ?

A. $AlCl_3$

B. $SiCl_4$

C. BF_3

D. $SnCl_4$

Answer: A::C::D

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12. Substances which readily undergo hydrolysis are

A. $AlCl_3$

B. BCl_3

C. $SiCl_4$

D. $PbCl_4$

Answer: A::B::C::D

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13. With respect to graphite and diamond, which of the statement given is correct?

A. Graphite is harder than diamond

B. Graphite has higher electrical conductivity than diamond

C. Graphite has higher thermal conductivity than diamond

D. Graphite has higher C-C bond order than diamond.

Answer: B::D

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Competition Focus Jee Main And Advanced Medical Entrance Iii Multiple Choice Questions

1. The heavier members of 13 and 14 groups besides the group oxidation state also show another oxidation state. Down the group ($\downarrow$), the stability of higher oxidation state increases. This concept which is commonly called inert pair effect has been used to explain many physical and chemical properties of the element of these groups.

Which among the following is the strongest oxidising agent ?

A. SnO_2

B. SiO_2

C. GeO_2

D. PbO_2

Answer: D

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2. The heavier elements of groups 13 and 14 besides the group oxidation state exhibit another oxidation state which is two units lower than the group oxidation state and the stability of this lower oxidation state increases down the group. This concept which is commonly called inert pair effect has been used to explain many physical and chemical properties of the element of these groups.

The strongest reductant among the following is

A. $GeCl_2$

B. $SnCl_2$

C. $PbCl_2$

D. $SnCl_4$

Answer: A

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3. The heavier elements of groups 13 and 14 besides the group oxidation state exhibit another oxidation state which is two units lower than the group oxidation state and the stability of this lower oxidation state increases down the group. This concept which is commonly called inert pair effect has been used to explain many physical and chemical properties of the element of these groups.

Element of group 13

A. exhibit oxidation state of $+3$ only

B. form M^{+} and M^{3+} ions

C. exhibit oxidation states of +1 and +3

D. form M^{-} and M^{+} ions

Answer: C

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4. The heavier elements of groups 13 and 14 besides the group oxidation state exhibit another oxidation state which is two units lower than the group oxidation state and the stability of this lower oxidation state increases down the group. This concept which is commonly called inert pair effect has been used to explain many physical and chemical properties of the element of these groups.

Which of the following statements is incorrect ?

A. CO is used as a reducing agent

B. $Tl(III)$ salts undergo disproportionation

C. CO_2 is a greenhouse gas

D. SiO_2 is a covalent solid

Answer: B

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5. The heavier elements of groups 13 and 14 besides the group oxidation state exhibit another oxidation state which is two units lower than the

group oxidation state and the stability of this lower oxidation state increases down the group. This concept which is commonly called inert pair effect has been used to explain many physical and chemical properties of the element of these groups.

The oxides which is the strongest acid is

A. Tl_2O_3

B. PbO_2

C. CO_2 is a greenhouse gas

D. SnO_2

Answer: C

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Competition Focus Jee Main And Advanced Medical Entrance Iv Matching Type Questions

1.

	Column I		Column II
(A)	An element with $+1$ stable oxidation state	(p)	lead
(B)	A neutral oxide	(q)	Dry ice
(C)	An element with stable $+2$ oxidation state	(r)	Thallium
(D)	Solid carbon dioxide	(s)	Carbon monoxides

A. A-p,B-q,C-r,D-s

B. A-r,B-s,C-p,D-q

C. A-r,B-p,C-q,D-s

D. A-q,B-s,C-r,D-p

Answer: B

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2.

	Column I		Column II
(A)	Shows inert pair effect	(p)	InCl
(B)	Shows $p\pi - p\pi$ back bonding	(q)	Ga
(C)	Shows disproportionation reaction	(r)	$Na(SiH_3)_3$
(D)	Shows $p\pi - d\pi$ back bonding	(s)	BF_3

A. A-p,B-r,C-q,D-s

B. A-r,B-p,C-q,D-s

C. A-q,B-s,C-p,D-r

D. A-s,B-q,C-p,D-r

Answer: C

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	Column I		Column II
	(A) Inorganic benzene	(p)	An allotrope of carbon
3.	(B) Fulerene	(q)	Orthosilicate
	(C) Phenacite	(r)	An ore of boron
	(D) Colemanite	(s)	Borazine$(B_3N_3H_6)$

A. A-s,B-p,C-r,D-q

B. A-p,B-s,C-q,D-r

C. A-q,B-r,C-s,D-p

D. A-s,B-p,C-q,D-r

Answer: D

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Competition Focus Jee Main And Advanced Medical Entrance V Matric Match Type Questions

1.

	Column I		Column II
(A)	$Bi^{3+} \rightarrow (BiO)^{+}$	(p)	Heat
(B)	$[AlO_2]^{-} \rightarrow Al(OH)_3$	(q)	Hydrolysis
(C)	$SiO_4^{4-} \rightarrow Si_2O_7^{6-}$	(r)	Acidification
(D)	$(B_4O_7)^{2-} \rightarrow [B(OH)_3]$	(s)	Dilution by water

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2.

	Column I		Column II
(A)	B_2H_6	(p)	Borax
(B)	BF_3	(q)	Lewis acid
(C)	$AlCl_3$	(r)	$p\pi - p\pi$ back bonding
(D)	H_3BO_3	(s)	$NaBH_4$

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Competition Focus Jee Main And Advanced Medical Entrance Vi Integer Type Questions

1. Number of B-O-B bond in borax

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2. Three moles of B_2H_6 are completely reacted with methanol. The number of moles of boron containing product formed is.

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3. How many crystalline allotropic forms of carbon are known ?

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4. Amongst the following, the maximum number of compounds which do not behave as Lewis acids are :

$SnCl_2, H_3BO_3, AlCl_3, CF_4, SiF_4, CCl_4, BF_3, SnCl_4$

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5. Total number of elements of group 13 and 14 which form basic oxides is

A. How many silicon atoms are present in the anion of a pyrosilicates ?

B.

C.

D.

Answer: 1

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6. How many silicon atoms are present in the atom are present in the anion of a pyrosilicates ?

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Competition Focus Jee Main And Advanced Medical Entrance Vii Numerical Value Type Questions

1. 27g of Al was treated with NaOH solution when a white gelatinous precipitate was obtained which upon strong heating gave an oxide. The amount of oxide (in g) is

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Competition Focus Jee Main And Advanced Medical Entrance Viii Assertion Reason Type Questions Type I

1. Assertion: Boron always froms covalent bond.

Reason: The small size of B^{3+} favours formation of covalent bond.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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2. $TlCl_3$ is more stable than $TlCl$.

$+1$ oxidation state of thallium us more stable than $+3$.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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3. Statement-1. BF_3 is a weaker Lewis acid than BCl_3.

Statement-2. The $p\pi - p\pi$ back bonding is stronger in BF_3 than in BCl_3.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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4. Statement-1. Aluminium acts as a strong affinity for oxygen.

Statement-2. Aluminium has a strong affinity for oxygen.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

View Text Solution

5. Statement I In water, orthoboric acid behaves as a weak monobasic acid.

Statement II In water, orthoboric acid acts as a proton donor.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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6. In B_2H_6, there is no $B-B$ bond.

The $B_2H_6.2NH_3$ adduct on heating gives borazine.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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7. Statement-1. $(SiH_3)_HN$ is a weaker base than $(CH_3)_3N$.

Statement-2. Due to $p\pi - d\pi$ back bonding the availability of electrons on the N atom in $(SiH_3) + (3)N$ decreases.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

View Text Solution

8. Statement-1. Pb^{4+} compounds are stronger oxidizing agent than Sn^{4+} compounds.

Statement-2. The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to inert pair effect.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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9. Statement-1. CO_2 is a gas but SiO_2 is a solid at room temperature.

Statement-2. CO_2 contains $C = O$ bonds but $C = O$ bonds but SiO_2 has a three-directional network structure.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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10. Assertion. Al and Ga have nearly same atomic radii.

Reason. Al and Ga diagonal relationship.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: C

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11. Assertion: Boron always froms covalent bond.

Reason: The small size of B^{3+} favours formation of covalent bond.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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12. Assertion. Coloured cations can be identified by borax bead test.

Reason. Transparent bead $(NaBO_2 + B_2O_3)$ forms coloured bead with coloured cation.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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13. Borax bead test is not suitable of for $Al(III)$

Al_2O_3 is insoluble in H_2O.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: B

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14. Assertion. SiF_6^{2-} is known but $SiCl_6^{2-}$ is not.

Reason. Size of F is small and its lone pair of electrons interact with d-orbitals of Si strongly.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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15. Assertion (A): $PbCl_2$ is more stable than $PbCl_4$.

Reason (R): $PbCl_4$ is a powerful oxidising agent.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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16. Assertion. PbI_4 is a stable than $PbCl_4$.

Reason. Iodide ion stabilizes higher oxidation state.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: D

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17. Assertion (A) : SnI_4 is an orange solid .

Reason (R) : The colour arises due to charge transfer .

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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18. Assertion : Between $SiCl_4$ and CCl_4 only $SiCl_4$ reacts with water.

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

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: C

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19. Assertion. Diamond is the hardest possible substance and is a network covalent solid.

Reason. All the C atoms in diamond are sp^3 hybridised.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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20. Assertion (A) Graphite is a good conductor of heat and electicity.

Reason (R) Graphite has all the electrons firmly held together in $C - C\sigma$ bonds.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: C

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21. Assertion (A) : C_{60} fullerence is an allotrope OF carbon.

Reason (R) :In C_{60} fullerene , five -membered rings are isolated from each other .

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: B

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22. Assertion. Carbon monoxide is highly toxic.

Reason. Carbon monoxide forms a stable complex with hemoglobin

present in red blood cells.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: A

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23. Assertion: Silicones are hydrophobic in nature.

Reason: $Si - O - Si$ linkage are moisture sensitive.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason not is the true explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false.

Answer: C

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