



CHEMISTRY

BOOKS - NCERT CHEMISTRY (ENGLISH)

THE P-BLOCK ELEMENTS

Mcqs

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

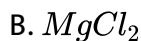
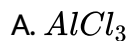
- A. *B*
- B. *Al*
- C. *Ga*
- D. *In*

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.

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

A. contains replaceable 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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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. $C > Si > Ge \approx Sn$

C. $Si > C > Sn > Ge$

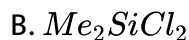
D. $Ge > Sn > Si > C$

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



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 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 lie in one plane and two terminal hydrogen atoms lie in a plane perpendicular to this plane

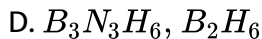
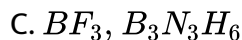
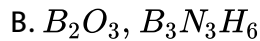
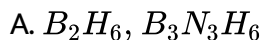
D. All the atoms are in the same plane

Answer: B



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11. A compound of boron X reacts at 200°C temperature with NH_3 to give another compound Y which is called as inorganic benzene. The compound Y is a colourless liquid and is highly light sensitive. Its melting point is -57°C . The compound X with excess of NH_3 and at a still higher temperature gives boron nitride $(\text{BN})_n$. The compounds X and Y are respectively:



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. $AlCl_3$

B. $PbCl_2$

C. $SnCl_4$

D. SnCl_2

Answer: D



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14. Dry ice is

A. solid NH_3

B. solid SO_2

C. solid CO_2

D. solid N_2

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

- A. poor screening effect of d and f-orbitals
- B. increase in nuclear charge
- C. presence of higher orbitals

D. higher atomic number

Answer: A



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17. 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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18. Me_3SiCl is used during polymerisation of organo silicones because

- A. chain length of organo silicone 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 polymerisation

Answer: A:B



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19. Which of the following statements are correct ?

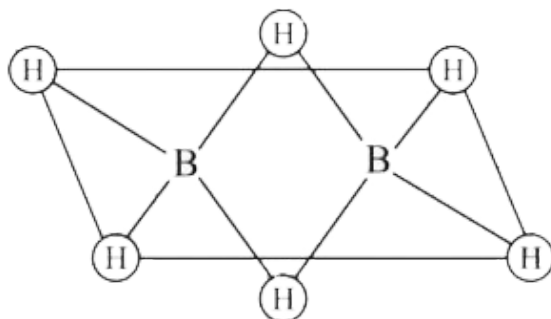
- A. Fullerenes have dangling bonds
- B. Fullerenes are cage-like molecules
- C. Graphite is thermodynamically most stable allotrope of carbon
- D. Graphite is slippery and hard and therefore used as a dry lubricant in machines.

Answer: B



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20. Which of the following statements are correct. Answer on the basis of figure :



- A. The two bridged hydrogen atoms and the two boron atoms lie in one plane
- B. Out of six B-H bonds two bonds can be described in terms of 3 centre 2 electron bonds

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

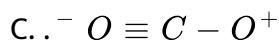
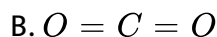
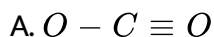
D. The four terminal B-H bonds are two centre-two electron regular bonds

Answer: A



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



Answer: D

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Short Answer

1. Draw the structures 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 compounds behave as Lewis acids ?

(a) BCl_3

(b) $AlCl_3$



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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 in spite 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 $[B(OH)_4]^-$ only whereas $AlCl_3$ in acidified aqueous solution forms $[Al(H_2O)_6]^{3+}$ ion. Explain what is the hybridisation of boron and aluminium in these species ?



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11. Aluminium dissolves in mineral acids and aqueous alkalies and thus shows amphoteric character. A piece of aluminium foil is treated with diluted hydrochloric acid or dilute sodium hydroxide solution in a test tube and on bringing a burning matchstick near the mouth of the test tube, a pop sound indicates the evolution of hydrogen gas.

The same activity when performed with concentrated nitric acid, reaction doesn't proceed. Explain the reason.



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12. Explain the following

(a) Gallium has higher ionisation enthalpy than aluminium

(b) Boron does not exist as B^{3+} ion

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

(d) PbX_2 is more stable than PbX_4

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

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

(g) $Tl(NO_3)_3$ acts as an oxidising agent

(h) Carbon shows catenation property but lead does not

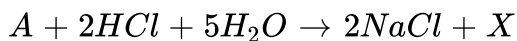
(i) BF_3 does not hydrolyse

(j) Why does the element silicon, not form a graphite like structure whereas carbon does ?



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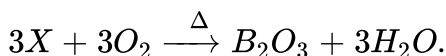
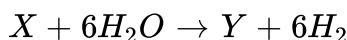
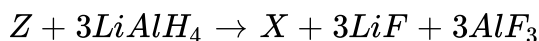
13. Identify the compounds A, X and Z in the following reactions





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14. Complete the following chemical equations



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Matching

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. Aluminosilicate	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 $[Al(H_2O)_6]^{3+}$	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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1. Assertion (A) : If aluminium atoms replace a few silicon atoms in three dimensional network of silicon dioxide, the overall structure acquires 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 but 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: d



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

Reason (R) : Silicones are organosilicon polymers, which have

($-R_2SiO-$) as repeating unit.

- A. A and R both are correct R is the correct explanation of A
- B. Both A and R are correct but R is not the correct explanation of A
- C. A and R both are correct
- D. A is not correct but R is correct

Answer: b



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Long Answer

1. Describe the general trends in the following properties of the elements in groups 13 and 14
 - (a) Atomic size
 - (b) Ionisation enthalpy
 - (c) Metallic character

(d) Oxidation states

(e) Nature of halides.



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2. Account for the following observations

(a) $AlCl_3$ is a Lewis acid

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

(c) PbO_2 is a stronger oxidising agent than SnO_2

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



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3. 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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4. 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. Given reason for your choice. State the nature of bonding also

(a) $TlCl_3$, $TlCl$

(b) $AlCl_3$, $AlCl$

(c) $InCl_3$, $InCl$



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5. Boron fluoride exists as BF_3 but boron hydride doesn'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 react with NMe_3 to give an adduct (B) which in hydrolysis gives a compound (C) and hydrogen gas. Compound (C) is an acid. Indentfity the compounds A,B and C. Give the reactions involved.

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8. A non-metallic element of group 13, used in making bullet proof vests is extremely hard solid of black colour. It can exist in many allotropic forms and has unusually 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 its trifluoride with ammonia Explain why does the trifluoride act as a Lewis acid ?

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9. A tetravalent element forms monoxide and dioxide with oxygen. When air is passed over heated element (1273 K), producer gas is obtained. Monoxide of the element is a powerful reducing agent and reduces ferric oxide to iron

Identify the element and write formulae 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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