Some P-block Elements

Question1

Identify the incorrect statement from the following :

[NEET 2024 Re]

Options:

A.

The acidic strength of HX (X = F, Cl, Br and I) follows the order: HF > HCl > HBr > HI.

B.

Fluorine exhibits -1 oxidation state whereas other halogens exhibit +1, +3, +5 and +7 oxidation states also.

C.

The enthalpy of dissociation of F_2 is smaller than that of Cl_2.

D.

Fluorine is stronger oxidising agent than chlorine.

Answer: A

Solution:

The acidic strength of HX follows the order HF < HCl < HBr < HI

This is because bond enthalpy of hydrides of group 17 decreases down the group.

Question2

Match List-I will List-II:

	List-I (Solid salt treated with dil. H_2SO_4)		List-II (Anion detected)
A.	effervescence of colourless gas	I.	NO_2^-
B.	gas with smell of rotten egg	II.	CO_3^{2-}
C.	gas with pungent smell	III.	S^{2-}
D.	brown fumes	IV.	SO_3^{2-}

Choose the correct answer from the options given below:

[NEET 2024 Re]

Options:

A.

A-II, B-III, C-IV, D-I

B.

A-IV, B-III, C-II, D-I

C.

A-I, B-II, C-III, D-IV

D.

A-II, B-III, C-I, D-IV

Answer: A

Solution:

	Anion	-	Observation on treatment with dil. H_2SO_4
A.	Carbonate (CO_3^{2-})	-	Brisk effervescence of colourless and odourless gas (CO_2)
B.	Sulphide (S^{2-})	-	Evolution of colourless gas with rotten egg like smell (H_2S)
C.	Sulphite (SO_3^{2-})	-	Gas with pungent smell (SO_2)
D.	Nitrite (NO_2^-)	-	Brown fumes (NO_2)

Correct Match : A – II, B-III, C-IV, D-I

Question3

Among Group 16 elements, which one does NOT show -2 oxidation state?

[NEET 2024]

Options:

A.

O

B.

Se

C.

Te

D.

Po

Answer: D

Solution:

Oxygen shows −2, −1, +1 and +2 oxidation states

Selenium shows −2, +2, +4 and +6 oxidation states

Tellurium shows −2, +2, +4 and +6 oxidation states

Polonium shows +2 and +4 oxidation states

Question4

Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.

A. Al^{3+}

B. Cu^{2+}

C. Ba^{2+}

D. Co^{2+}

E. Mg^{2+}

Choose the correct answer from the options given below.

[NEET 2024]

Options:

A.

B, A, D, C, E

B.

B, C, A, D, E

C.

E, C, D, B, A

D.

E, A, B, C, D

Answer: A

Solution:

Group	Cations
Group-II	Cu^{2-}
Group-III	Al^{3+}
Group-IV	Co^{2-}
Group-V	Ba^{2-}
Group-VI	Mg^{2+}

The correct order of group number of ions is $\underset{(B)}{Cu^{2+}} < \underset{(A)}{Al^{3-}} < \underset{(D)}{Co^{2+}} < \underset{(C)}{Ba^{2+}} < \underset{(E)}{Mg^{2+}}$

∴ The correct order is B, A, D, C, E

Question5

Amongst the given options which of the following molecules/ ion acts as a Lewis acid?

[NEET 2023]

Options:

A.

H_2O

B.

BF_3

C.

OH^-

D.

NH_3

Answer: B

Solution:

Solution

Lewis acids are the one which accepts lone pair of electron due to presence of vacant orbital in outermost shell.

$H_2\ddot{O}: \rightarrow$ Lewis base

$BF_3 \rightarrow$ Lewis acid

$\ddot{N}H_3 \rightarrow$ Lewis base

Question6

Taking stability as the factor, which one of the following represents correct relationship?

[NEET 2023]

Options:

A.

$|In_3 > In|$

B.

$AlCl > AlCl_3$

C.

$T\ell l > T\ell l_3$

D.

$T\ell Cl_3 > T\ell Cl$

Answer: C

Solution:

Solution

As we move down the group, due to poor shielding effect of intervening d and f orbitals, the increased effective nuclear charge holds ns electrons tightly and therefore restricting their participation in bonding.

So, the relative stability of +1 O.S increases for heavier elements.

E° for $In^{3+} | In^{-} = -0.16V$

E° for $T\ell^{3+} | T\ell^{-} = +1.6V$

Hence, $T\ell I$ is more stable than $T\ell l_3$

Question7

Match List-I with List-II.

	List-I		List-II
A.	Coke	I.	Carbon atoms are sp^3 hybridised
B.	Diamond	II.	Used as a dry lubricant
C.	Fullerene	III.	Used as a reducing agent
D.	Graphite	IV.	Cage like molecules

Choose the correct answer from the options given below :

[NEET 2023]

Options:

A.

A-IV, B-I, C-II, D-III

B.

A-III, B-I, C-IV, D-II

C.

A-III, B-IV, C-I, D-II

D.

A-II, B-IV, C-I, D-III

Answer: B

Solution:

Solution

- Coke is largely used as a reducing agent in metallurgy.
- In diamond, each carbon atom undergoes sp^3 hybridisation and linked to four other carbon atoms by using hybridised orbitals in tetrahedral fashion.
- Buckminsterfullerene contains six membered and five membered rings and hence is a cage like molecule.
- Graphite is very soft and slippery. Hence, it is used as a dry lubricant in machines running at high temperature.

Question8

The List-I with List-II

List-I(Hydride)	List-II (Type of Hydride)
(A) NaH	(I) Electron precise
(B) PH_3	(II) Saline
(C) GeH_4	(III) Metallic
(D) $LaH_{2.87}$	(IV) Electron rich

Choose the correct answer from the options given below :

[NEET 2023 mpr]

Options:

A.

(A)-(III), (B)-(IV), (C)-(II), (D)-(I)

B.

(A)-(II), (B)-(III), (C)-(IV), (D)-(I)

C.

(A)-(I), (B)-(III), (C)-(II), (D)-(IV)

D.

(A)-(II), (B)-(IV), (C)-(I), (D)-(III)

Answer: D

Solution:

$LaH_{2.87}$ → non-stoichiometric

→ Metallic/Interstitial hydride.

Question9

Which of the following statement is not correct about diborane? [NEET-2022]

Options:

A. There are two 3-centre-2-electron bonds.

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

C. The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.

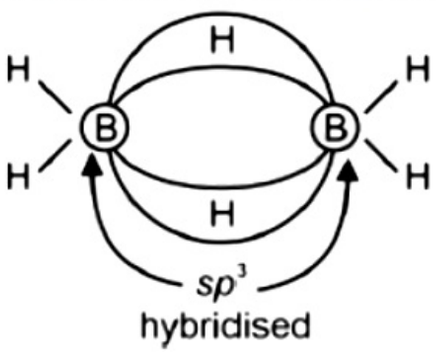
D. Both the Boron atoms are sp^2 hybridised.

Answer: D

Solution:

Solution

Each boron atoms in diborane uses sp^3 hybrid orbitals for bonding.



Question10

Choose the correct statement: [NEET-2022]

Options:

A. Diamond and graphite have two dimensional network.

B. Diamond is covalent and graphite is ionic.

C. Diamond is sp^3 hybridised and graphite is sp^2 hybridized.

D. Both diamond and graphite are used as dry lubricants.

Answer: C

Solution:

The correct statement about diamond and graphite is "Diamond is $\mathrm{mathrm}\, sp^3$ hybridized and graphite is sp ^{2} hybridized".As in diamond -

- - 3-D structures of carbon atoms joined together by covalent bonds are found.
- - Each carbon atom is tetrahedrally connected to other carbon atoms with a covalent bond.
- - Thus, the hybridization of each carbon atom in diamond is sp^3.

In the case of graphite -

- - It is a 2-D structure of carbon atoms joined together in form of layers of graphene.
- - each carbon atom is connected to three other carbon atoms, by 3σ and 1π bonds.
- - Thus, the hybridization of each carbon atom in graphite is sp^2.

Other statements are incorrect as-

- - Diamond cannot be used as a dry lubricant because of its extreme hardness.
- - Both diamond and graphite are covalent solid.
- - Diamond is a 3-D structure and graphite is 2-D.

Question11

List - I (Compounds)	List - II (Molecular formula)
(a) Borax	(i) $NaBO_2$
(b) Kernite	(ii) $Na_2B_4O_7 \cdot 4H_2O$
(c) Orthoboric acid	(iii) H_3BO_3
(d) Borax bead	(iv) $Na_2B_4O_7 \cdot 10H_2O$

[NEET Re-2022]

Options:

A. (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

B. (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

C. (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

D. (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

Answer: B

Solution:

Borax $\rightarrow Na_2B_4O_7 \cdot 10H_2O$

Kernite $\rightarrow Na_2B_4O_7 \cdot 4H_2O$

Orthoboric acid $\rightarrow H_3BO_3$

Borax bead $\rightarrow NaBO_2$

Question12

$Na_2B_4O_7 \xrightarrow{heat} X + NaBO_2$
in the above reaction the product " X " is :
[NEET Re-2022]

Options:

A. NaB_3O_5

B. H_3BO_3

C. B_2O_3

D. $Na_2B_2O_5$

Answer: C

Solution:

Borax on strong heating produces

Boric anhydride and sodium metaborate

$$Na_2B_4O_7 \xrightarrow{heat} B_2O_3 + 2NaBO_2$$

Question13

Match the following and identify the correct option.

(A) $CO(g) + H_2(g)$	(i) $Mg(HCO_3)_2 + Ca(HCO_3)_2$
(B) Temporary hardness of water	(ii) An electron deficient hydride
(C) B_2H_6	(iii) Synthesis gas
(D) H_2O_2	(iv) Non-planar structure

[2020]

Options:

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

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

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

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

Answer: D

Solution:

Solution:
A. Mixture of CO and H_2 gases is known as water gas or synthesis gas.
B. Temporary hardness of water is due to bicarbonates of calcium and magnesium.
C. Diborane (B_2H_6) is an electron deficient hydride.
D. H_2O_2 is non-planar molecule having open book like structure.

Question14

Which of the following is not correct about carbon monoxide ? [2020]

Options:

A. It reduces oxygen carrying ability of blood.

B. The carboxyhaemoglobin (haemoglobinbound to CO) is less stable than oxyhaemoglobin.

C. It is produced due to incomplete combustion.

D. It forms carboxyhaemoglobin

Answer: B

Solution:

Solution:
(b) The carboxyhaemoglobin (haemoglobin bound to CO), is about 300 times more stable than oxygaemoglobin.

Question15

Identify the correct statements from thefollowing :
(A) CO_2(g) is used as refrigerant for ice-cream and frozen food.
(B) The structure of C_{60} contains twelve six carbon rings and twenty five carbon rings.
(C) ZSM-5, a typeof zeolite, is used to convert alcohols into gasoline.

(D) CO is colorless and odourless gas.
[2020]

Options:

A. (A) and (C) only

B. (B) and (C) only

C. (C) and (D) only

D. (A), (B) and (C) only

Answer: C

Solution:

Solution:
a) CO_2 in solid state used as refrigerant for ice-cream and frozen food because of its sublimation properties. Sublimation is a process in which a solid directly goes into gaseous state without going into liquid state.
b) The structure of C_{60} contains twelve five-carbon rings and twenty six-carbon rings. Hence the given statement was wrong.
c) Z SM -5, a type of zeolite, is used to convert alcohol into gasoline. The statement is correct.
d) CO is a colorless and odourless gas. True.

Question16

Which of the following is incorrect statement?
(NEET 2019)

Options:

A. SnF_4 is ionic in nature.

B. PbF_4 is covalent in nature.

C. $SiCl_4$ is easily hydrolysed.

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

Answer: B

Solution:

Solution:
Generally halides of group-14 elements are covalent in nature. PbF_4 and SnF_4 are exceptions which are ionic in nature.

Question17

Which of the following species is not stable?
(NEET 2019)

Options:

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

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

C. $[GeCl_6]^{2-}$

D. $[Sn(OH)_6]^{2-}$

Answer: A

Solution:

Solution:
$[SiCl_6]^{2-}$ is not stable due to steric hindrance by large sized Cl atoms.

Question18

Which of the following compounds is used in cosmetic surgery?
(Odisha NEET 2019)

Options:

A. Silica

B. Silicates

C. Silicones

D. Zeolites

Answer: C

Solution:

Solution:
Silicones being biocompatible are used in surgical and cosmetic plants.

Question19

Which one of the following elements is unable to form MF_6^{3-} ion?
(NEET 2018)

Options:

A. Ga

B. Al

C. B

D. In

Answer: C

Solution:

Solution:
Boron does not have vacant d -orbitals in its valence shell, so it cannot extend its covalency beyond 4. i.e., 'B' cannot form the ions like MF_6^{3-}

Question20

It is because of inability of ns^2 electrons of the valence shell to participate in bonding that
(NEET 2017)

Options:

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+} is oxidising.

Answer: D

Solution:

Solution:
The inertness of s -subshell electrons towards bond formation is known as inert pair effect. This effect increases down the group thus, for Sn, +4 oxidation state is more stable, whereas, for Pb, +2 oxidation state is more stable, i.e., Sn^{2+} is reducing while Pb^{4+} is oxidising.

Question21

Boric acid is an acid because its molecule
(NEET- II 2016)

Options:

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

Solution:

Solution:
Boric acid behaves as a Lewis acid, by accepting a pair of electrons from OH^- ion of water thereby releasing a proton.

Question22

AlF_3 is soluble in HF only in presence of KF. It is due to the formation of
(NEET- II 2016)

Options:

A. $K_3[AlF_3H_3]$

B. $K_3[AlF_6]$

C. AlH_3

D. $K[AlF_3H]$

Answer: B

Solution:

Solution:
AlF_3 is insoluble in anhydrous HF because the F^- ions are not available in hydrogen bonded HF but, it becomes soluble in presence of little amount of KF due to formation of complex, $K_3[AlF_6]$
$AlF_3 + 3KF \rightarrow K_3[AlF_6]$

Question23

The stability of + 1 oxidation state among Al, Ga, In and T1 increases in the sequence
(2015,2009)

Options:

A. Al < Ga < In < Tl

B. Tl < In < Ga < Al

C. In < Tl < Ga < Al

D. Ga < In < Al < Tl

Answer: A

Solution:

Solution:
In group 13 elements, stability of +3 oxidation state decreases down the group while that of +1 oxidation state increases due to inert pair effect.
Hence, stability o f+1 oxidation state increases in the sequence ∴ Al < Ga < In < Tl.

Question24

The basic structural unit of silicates is (2013 NEET)

Options:

A. SiO_3^{2-}

B. SiO_4^{2-}

C. SiO^-

D. SiO_4^{4-}

Answer: D

Solution:

Solution:
SiO_4^{4-} ortho-silicate is basic unit of silicates,

Question25

Which of these is not a monomer for a high molecular mass silicone polymer? (2013 NEET)

Options:

A. Me_3SiCl

B. $PhSiCl_3$

C. $MeSiCl_3$

D. Me_2SiCl_2

Answer: A

Solution:

Solution:
It can form only dimer.

Question26

Which of the following structure is similar to graphite? (2013 NEET)

Options:

A. B_4C

B. B_2H_6

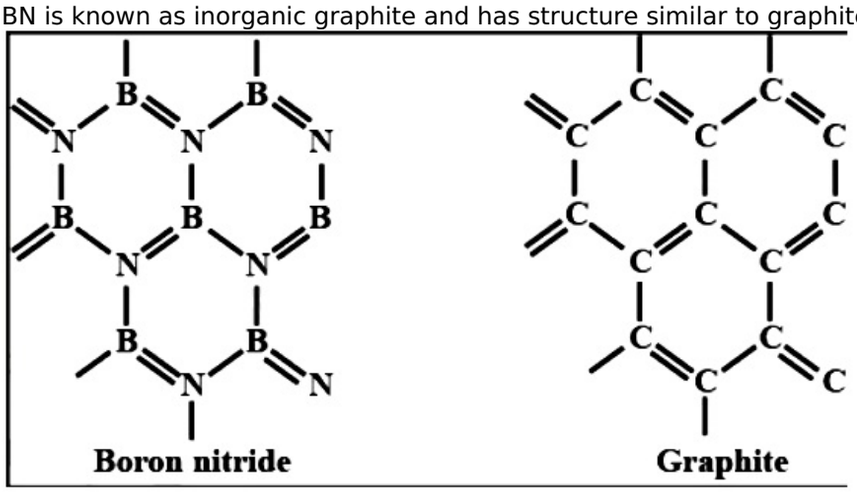
C. BN

D. B

Answer: C

Solution:

BN is known as inorganic graphite and has structure similar to graphite



Question27

Which statement is wrong?
(Karnataka NEET 2013)

Options:

A. Beryl is an example of cyclic silicate.

B. Mg_2SiO_4 is orthosilicate.

C. Basic structural unit in silicates is the SiO_4 tetrahedron.

D. Feldspars are not aluminosilicates.

Answer: D

Solution:

Solution:
Feldspars are three dimensional aluminosilicates.

Question28

Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of
(2012)

Options:

A. $Al_2O_3 + HF + NaAlF_4$

B. $Al_2O_3 + CaF_2 + NaAlF_4$

C. $Al_2O_3 + Na_3AlF_6 + CaF_2$

D. $Al_2O_3 + KF + Na_3AlF_6$

Answer: C

Solution:

Solution:
Electrolytic mixture contains alumina (Al_2O_3),cryolic Na_3AlF_6 and fluorspar CaF_2 in the ratio of 20 : 40 : 2 Due to presence of these conductivity of alumina increases and fusion temperature decreases from 2000°C to 900°C.

Question29

Which of the following oxide is amphoteric?

(2011 mains)

Options:

A. SnO_2

B. CaO

C. SiO_2

D. CO_2

Answer: A

Solution:

SnO_2 reacts with acid as well as base.So SnO_2 amphoteric
$SnO_2 + 4HCl \rightarrow SnCl_2 + 2H_2O$
$SnO_2 + 2NaOH \rightarrow Na_2SnO_3 + H_2O$
CaO is basic in nature while SiO_2 and CO_2 are acidic nature

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Question30

**Which of the following statements is incorrect?
(2011 Mains)**

Options:

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

B. NaOH reacts with glass to give sodium silicate.

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

D. $NaHCO_3$ on heating gives Na_2CO_3

Answer: C

Solution:

Solution:
Al reacts with NaOH to give sodium meta aluminate.
$2Al + 2NaOH + 6H_2O \longrightarrow \underset{\text{sodium aluminate}}{2NaAl(OH)_4}$ or $(2NaAlO_2 \cdot 2H_2O) + 3H_2$

Question31

Name the two type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared
(2011)

Options:

A. Linear chain silicate

B. Sheet silicate

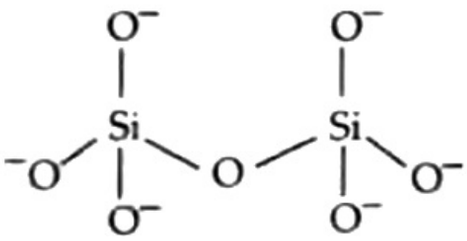
C. Pyrosilicate

D. Three dimensional

Answer: C

Solution:

Pyrosilicate contains two units of $[SiO_4]^{4-}$ joined along. comer containing oxygen atom.



Question32

Which one of the following molecular hydrides acts as a Lewis acid ?
(2010)

Options:

A. NH_3

B. H_2O

C. B_2H_6

D. CH_4

Answer: C

Solution:

According to the definition a molecule which can accept a lone pair is called a lewis acid.
A) Ammonia has a lone pair on nitrogen, so it can donate the lone pair rather than accepting a lone pair. So, it is a lewis base.
B)Water has 2 lone pairs on oxygen so it cannot accept any further lone pairs, so water is a lewis base not a lewis acid.
C)In diborane the bonds found are banana bonds or tau bonds so it has a tendency to accept a lone pair because it has

empty orbitals.So it can be considered as a lewis acid.
D)Carbon usually doesn't accept or donate lone pair, so it is neither a lewis base nor lewis acid.We can consider it as a neutral molecule.

Question33

The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence (2010)

Options:

A. $BCl_3 > BF_3 > BBr_3$

B. $BBr_3 > BCl_3 > BF_3$

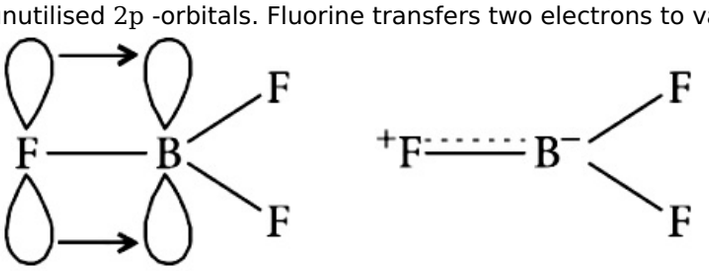
C. $BBr_3 > BF_3 > BCl_3$

D. $BF_3 > BCl_3 > BBr_3$

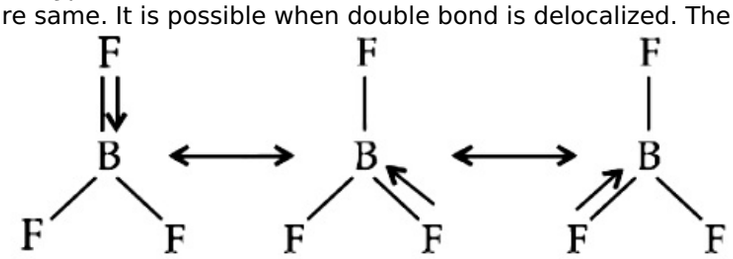
Answer: B

Solution:

Solution:
The relative Lewis acid character of boron trihalides is found to follow the following order.
$BBr_3 > BCl_3 > BF_3$ but the expected order on the basis of electronegativity of the halogens (electronegativity of halogens decreases from F to I) should be,
$BF_2 > BCl_2 > BBr_2$
This anomaly is explained on the basis of the relative tendency of the halogen atom to back donate its unutilised electrons to vacant p -orbital of boron atom. In BF_3, boron has a vacant $2p$ -orbital and each fluorine has fully filled unutilised $2p$ -orbitals. Fluorine transfers two electrons to vacant $2p$ -orbital of boron, thus forming $p\pi - p\pi$ bond.



This type of bond has some double bond character and is known as dative or back bonding. All the three bond lengths are same. It is possible when double bond is delocalized. The delocalization may be represented as :



The tendency to back donate decreases from F to I as energy level difference between B and halogen atom increases from F to I . So, the order is
$BF_3 < BCl_3 < BBr_3$

Question34

The straight chain polymer is formed by

(2009)

Options:

A. hydrolysis o f CH_3SiCl_3 followed by condensation polymerisation

B. hydrolysis of $(CH_3)_2Si$ by addition polymerisation

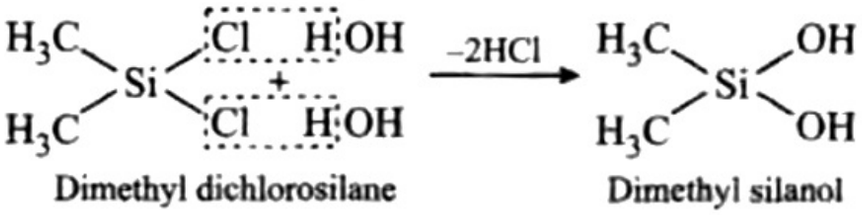
C. hydrolysis of $(CH_3)_2SiCl_2$ followed by condensation polymerisation

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

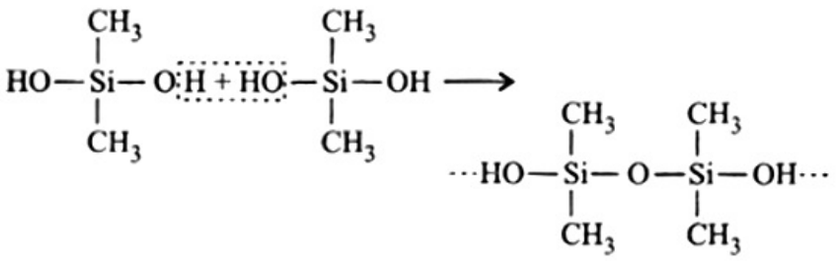
Answer: C

Solution:

Solution:
Hydrolysis of substituted chlorosilanes yields corresponding silanols which undergo polymerisation. Out of the given chlorosilanes, only $(CH_3)_2SiCl_2$ will give linear polymer on hydrolysis followed by polymerisation.



Dimethyl dichlorosilane Dimethyl silanol



Question35

The stability o f +1 oxidation state increases in the sequence (2009)

Options:

A. TI < In < Ga < Al

B. In < TI < Ga < Al

C. Ga < In < Al < Tl

D. Al < Ga < In < Tl

Answer: D

Solution:

Group-13 elements exhibit +3 and +1 oxidation states. Stability of the lower oxidation state increases on moving down the group, thus the order is $Al^{+} < Ga^{+} < In^{+} < Tl^{+}$

Question36

Which of the following anions is present in the chain structure of silicates?
(2007)

Options:

A. $(Si_2O_5^{2-})_n$

B. $(SiO_3^{2-})_n$

C. SiO_4^{4-}

D. $Si_2O_7^{6-}$

Answer: B

Solution:

Solution:
Chain silicates are formed by sharing two oxygen atoms by each tetrahedra. Anions of chain silicate have two general formula:
(i) $(SiO_3)_n^{2n-}$ (ii) $(Si_4O_{11})_n^{6n-}$

Question37

Which of the following oxidation states are the most characteristic for lead and tin respectively?
(2007)

Options:

A. +2, +4

B. +4, +4

C. +2, +2

D. +4, +2

Answer: A

Solution:

When ns^2 electrons of outermost shell do not participate in bonding then these ns^2 1 electrons are called inert pair and the effect is called inert pair effect. Due to this inert pair effect Ge, Sn and Pb of group IV have a tendency to form both +4 and +2 ions. Now the inert pair effect increases down the group, hence the stability of M^{2+} ions increases and M^{4+} + ions decreases down the group. For this reason,Pb^{2+} is more stable than Pb^{4+} and Sn^{4+} is more stable than Sn^{2+}

Question38

The correct order regarding the electronegativity of hybrid orbitals of carbon is
(2006)

Options:

A. $sp < sp^2 < sp^3$

B. $sp > sp^2 < sp^3$

C. $sp > sp^2 > sp^3$

D. $sp < sp^2 > sp^3$

Answer: C

Solution:

Solution:
Electronegativity of carbon atom is not fixed. It varies with the state of hybridisation. Electronegativity of carbon increases as the .-character of the hybrid orbital increases.
$C(sp) > C(sp^2) > C(sp^3)$

Question39

Which of the following is the most basic oxide?
(2006)

Options:

A. SeO_2

B. Al_2O_3

C. Sb_2O_3

D. Bi_2O_3

Answer: D

Solution:

SeO_2 ⟶ acidic oxide,
Al_2O_3, Sb_2O_3 ⟶ amphoteric
Bi_2O_3 – basic oxide.

Question40

Which one of the following statements about the zeolite is false? (2004)

Options:

A. They are used as cation exchangers.

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

C. Zeolites are aluminosilicates having three dimensional network.

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

Answer: D

Solution:

Solution:
Zeolites have SiO_4 and AlO_4 tetrahedrons, linked together in a three dimensional open structure in which four or six membered rings predominate. Due to open chain structure, they have cavities and can take up water and other small molecules.

Question41

Which one of the following compounds is not a protonic acid? (2003)

Options:

A. $B(OH)_3$

B. $PO(OH)_3$

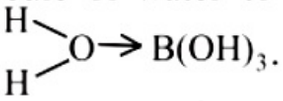
C. $SO(OH)_2$

D. $SO_2(OH)_2$

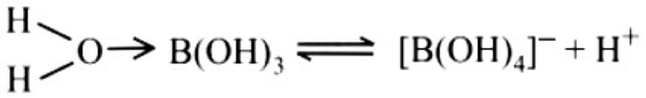
Answer: A

Solution:

$B(OH)_3$ in aqueous medium coordinates a molecule of water to form the hydrated species.



In this speices B^{3+} ion, because of its small size, has high polarizing power thereby pulling the sigma electron charge of the coordinated O atom towards itself. The coordinated oxygen, in turn, pulls the sigma electron charge of the OH bond of the attached water molecule towards itself. This facilitates the removal of H^+ ion from the $O-H$ bond.



Thus, the solution of $B(OH)_3$ in water acts as a weak acid, and it is not a protonic acid.

Question42

Which compound is electron deficient? (2000)

Options:

A. $BeCl_2$

B. BCl_3

C. CCl_4

D. PCl_5

Answer: B

Solution:

Solution:
In BCl_3 the central atom 'B' is sp^2 hybridised and contains only 'six' electrons in its valence shell. Therefore, it is electron deficient.

Question43

Which of the following does not show electrical conduction? (1999)

Options:

A. Diamond

B. Graphite

C. Potassium

D. Sodium

Answer: A

Solution:

Except diamond other three conduct electricity. Potassium and sodium are metallic conductors, while graphite is a non-metallic conductor.

Question44

The type of hybridisation of boron in diborane is (1999)

Options:

A. sp^3 -hybridisation

B. sp^2 -hybridisation

C. sp -hybridisation

D. sp^3d^2 -hybridisation.

Answer: A

Solution:

Solution:
Each 'B' atom in diborane (B_2H_6) is sp^3 -hybridised. Of the 4 -hybrid orbitals, three have one electron each, while the 4^{th} is empty. Two orbitals of each form σ bonds with two 'H'-atoms, while one of the remaining hybrid orbital (either filled or empty), 1s orbital of 'H atom and one of the hybrid orbitals of other 'B' atom overlap to form three centered two electron bond. So there exists two such type of three centered bonds.

Question45

Percentage of lead in lead pencil is (1999)

Options:

A. 80

B. 20

C. zero

D. 70

Answer: C

Solution:

Lead pencil contains graphite and clay. It does not contain lead.

Question46

In graphite, electrons are (1997,1993)

Options:

A. localised on each C-atom

B. localised on every third C-atom

C. spread out between the structureμ

D. present in antibonding orbital.

Answer: B

Solution:

Solution:
In graphite each carbon atom undergoes sp^2 -hybridisation and is covalently bonded to three other carbon atoms by single bonds. The fourth electron forms π bond. A graphite consists of two layers which are separated by a distance of 340pm

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Question47

Boron compounds behave as Lewis acids, because of their (1996)

Options:

A. ionisation property

B. electron deficient nature

C. acidic nature

D. covalent nature.

Answer: B

Solution:

Lewis acids are those substances which can accept a pair of electrons and boron compounds usually are deficient in electrons.

Question48

Aluminium (III) chloride forms a dimer because aluminium (1995)

Options:

A. belongs to 3^{rd} group

B. can have higher coordination number

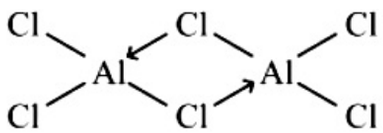
C. cannot form a trimer

D. has high ionization energy.

Answer: B

Solution:

$AlCl_3$ forms a dimer, as in Al due to the presence of 3d -orbitals it can expand it covalency from four to six. Also it enables Al atoms to complete their octets.



Question49

The BCl_3 is a planar molecule whereas NCl_3 is pyramidal because (1995)

Options:

A. nitrogen atom is smaller than boron atom

B. BCl_3 has no lone pair but NCl_3 has a lone pair of electrons

C. $B-Cl$ bond is more polar than $N-Cl$ bond

D. $N-Cl$ bond is more covalent than $B-Cl$ bond.

Answer: B

Solution:

There is no lone pair on boron in BCl_3 hence no repulsion takes place. There is a lone pair on nitrogen in NCl_3 hence repulsion takes place. Therefore, BCl_3 is planar molecule but NCl_3 is pyramidal molecule.

Question50

Carbon and silicon belong to (IV) group. The maximum coordination number of carbon in commonly occurring compounds is 4, whereas that of silicon is 6. This is due to
(1994)

Options:

A. availability of low lying d -orbitals in silicon

B. large size of silicon

C. more electropositive nature of silicon

D. both (b) and (c).

Answer: A

Solution:

Solution:
Carbon has no d -orbitals, while silicon contains d -orbitals in its valence shell which can be used for bonding purposes.

Question51

Which of the following statements about H_3BO_3 is not correct?
(1994)

Options:

A. It has a layer structure in which planar BO_3 units are joined by hydrogen bonds.

B. It does not act as proton donor but acts as a Lewis acid by accepting hydroxyl ion.

C. It is a strong tribasic acid.

D. It is prepared by acidifying an aqueous solution of borax.

Answer: C

Solution:

Solution:
H_3BO_3 is a weak monobasic acid. We know that
$B(OH)_3 + H_2O \longrightarrow [B(OH)_4]^- + H^+$
Therefore it is a weak monobasic acid.

Question52

Na^+, Mg^{2+}, Al^{3+} and Si^{4+} are isoelectronic their ionic size will follow the order
(1993)

Options:

A. $Na^+ > Mg^{2+} < Al^{3+} < Si^{4+}$

B. $Na^+ < Mg^{2+} < Al^{3+} < Si^{4+}$

C. $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$

D. $Na^+ < Mg^{2+} > Al^{3+} < Si^{4+}$

Answer: C

Solution:

Solution:
In isoelectronic species as the charge on cations increases, their sizes decrease in that order. Thus the ionic sizes of the given cation (isoelectronic) decrease in the order: $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$

Question53

Which of the following types of forces bind together the carbon atoms in diamond?
(1992)

Options:

A. Ionic

B. Covalent

C. Dipolar

D. van der Waals

Answer: B

Solution:

Solution:
In diamond each carbon atom is sp^3 hybridized and thus forms covalent bonds with four other carbon atoms lying at the corners of a regular tetrahedron.

Question54

Which of the following is an insulator?
(1992)

Options:

A. Graphite

B. Aluminium

C. Diamond

D. Silicon

Answer: C

Solution:

Solution:
All the above are conductors except diamond. Diamond is an insulator.

Question55

Glass is a
(1991)

Options:

A. liquid

B. solid

C. supercooled liquid

D. transparent organic polymer.

Answer: C

Solution:

Solution:
Glass is a supercooled liquid which forms a non-crystalline solid without a regular lattice.

Question56

The ability of a substance to assume two or more crystalline structures is called

(1990)

Options:

A. isomerism

B. polymorphism

C. isomorphism

D. amorphism.

Answer: B

Solution:

Solution:
The phenomenon of existence of a substance in two or more crystalline structures is called polymorphism.

Question57

The substance used as a smoke screen in warfare is (1989)

Options:

A. $SiCl_4$

B. PH_3

C. PCl_5

D. acetylene.

Answer: A

Solution:

$SiCl_4$ gets hydrolysed in moist air and gives white fumes which are used as a smoke screen in warfare.
