

p-Block Elements

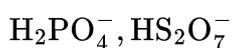
Question1

The conjugate base of phosphorus acid is x . The conjugate base of oleum is y . What are x and y , respectively?

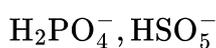
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Options:

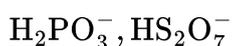
A.



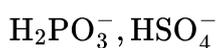
B.



C.



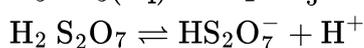
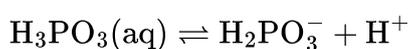
D.



Answer: C

Solution:

The conjugate base of phosphorus acid is H_2PO_3^- conjugate base of oleum is, HS_2O_7^-



Question2

Consider the following

Statement-I CCl_4 does not undergo hydrolysis. But SiCl_4 undergoes hydrolysis.

Statement-II Thermal and chemical stability of GeX_4 is more than GeX_2 .

The correct answer is

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Options:

A.

Both statement-I and statement-II are correct.

B.

Both statement-I and statement-II are not correct.

C.

Statement-I is correct, but statement-II is not correct.

D.

Statement-I is not correct, but statement-II is correct.

Answer: A

Solution:

Statement I:

CCl_4 does not undergo hydrolysis but SiCl_4 undergoes hydrolysis.

Explanation:

- In SiCl_4 , the central atom **Si** has *vacant 3d orbitals*.

→ Hence, water (a nucleophile) can attack the Si atom forming hydrolyzed products like silicic acid (via intermediate $\text{Si}(\text{OH})_4$).



- In CCl_4 , the central atom **C** does *not* have vacant d orbitals (carbon is limited to 2s and 2p orbitals only).

→ Therefore, nucleophilic attack by water is not possible, so **CCl_4 does not undergo hydrolysis.**

✔ **Statement I is correct.**

Statement II:

Thermal and chemical stability of GeX_4 is more than GeX_2 .

Explanation:

- Germanium belongs to Group 14.
→ As we go down the group, **+2 oxidation state becomes more stable** than +4 (due to the inert pair effect).
- However, for **Ge**, the +4 oxidation state is still **more stable** than the +2 state (the inert pair effect is not very pronounced yet).

So:

- **GeX_4 (Ge^{4+})** is more stable *thermally and chemically* than **GeX_2 (Ge^{2+})**.

✔ **Statement II is also correct.**

✔ **Final Answer:**

Option A: *Both Statement-I and Statement-II are correct.*

Question3

Orthophosphorus acid on disproportionation gives PH_3 and another oxoacid of phosphorus ' X '. The basicity of X is

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Options:

A.

2

B.

1



C.

3

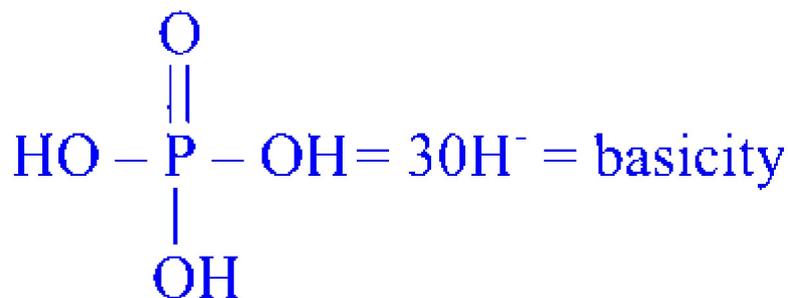
D.

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Answer: C

Solution:

The disproportionation reaction is,



Question4

The correct order of electronegativity of group 13 elements is

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Options:

A.



B.



C.



D.

$B > Tl > In > Ga > Al$

Answer: D

Solution:

The correct order of electronegativity of group 13 elements is,

$B > Tl > In > Ga > Al$

Electronegativity of 13th group generally decreases down the group with some exception due to inert pair effect.

Question5

Identify the correct statements.

I. CO reduces the oxygen carrying ability of blood

II. Producer gas contains CO and N_2

III. C – O bond length in CO_2 is 115 pm

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Options:

A.

I and III only

B.

I, II and III

C.

I and II only

D.

II and III only



Answer: B

Solution:

Statement I: *CO reduces the oxygen-carrying ability of blood.*

- **True.**

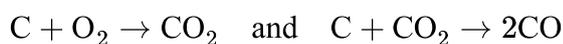
Carbon monoxide (CO) binds strongly with hemoglobin to form *carboxyhemoglobin*, which prevents hemoglobin from carrying oxygen effectively.

⇒ **True**

Statement II: *Producer gas contains CO and N₂.*

- **True.**

Producer gas is produced by passing air over red-hot coke:



Since air is used (not pure oxygen), nitrogen is also present.

Components \approx CO + N₂.

⇒ **True**

Statement III: *C–O bond length in CO₂ is 115 pm.*

- **True.**

In CO₂, there are two equivalent C=O bonds due to resonance.

Experimental bond length \approx **116 pm** — very close to 115 pm.

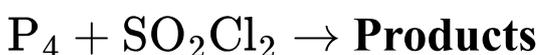
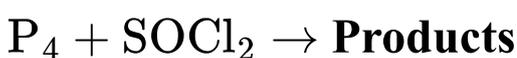
⇒ **True**

All three statements (I, II, III) are correct.

Correct option: Option B — I, II and III

Question6

Observe the following



In both the reactions, a common product ' x ' is obtained. The number of lone pair of electrons on the central atom of x is

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Options:

A.

1

B.

2

C.

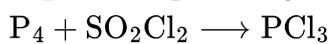
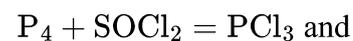
3

D.

0

Answer: A

Solution:



P has 5 valence electron 3

used in bonding with Cl

Thus, one lone pair of electron are present.

Question7

Identify the incorrect statement about silica.

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Options:

A.

It is acidic in nature.

B.

It has no reaction with most of acids except HF.

C.

With NaOH it forms sodium silicate.

D.

Like graphite, it has two dimensional structure.

Answer: D

Solution:

Statement (d) is incorrect regarding silica. The correct form is, While graphite has a two dimension layered structure, SiO_2 has three dimensional network structure.

Question8

The number of $\text{P} = \text{O}$, $\text{P} - \text{P}$ bonds present in oxoacid of phosphorus, prepared by treating red P_4 with alkali are respectively

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Options:

A.

2,1

B.

1,1

C.

1,2

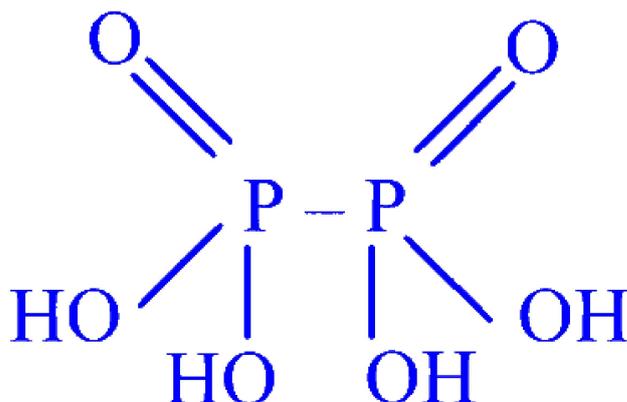
D.

2,2

Answer: A

Solution:

The oxoacid made when red P_4 reacts with alkali is :



Name of the acid :

It is called Hypophosphoric acid, with the formula $\text{H}_4\text{P}_2\text{O}_6$.

Counting bonds :

There are **two** P=O (double) bonds in this acid.

There is **one** P-P (single) bond in this acid.

Question9

Identify the incorrect statement about the group 13 elements.

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Options:

A.



Nature of aqueous solution of borax is alkaline.

B.

Orthoboric acid is a weak tribasic acid.

C.

Metaboric acid on heating gives an acidic oxide.

D.

LiBH_4 acts as a reducing agent.

Answer: B

Solution:

Among the given options, statement given in option (b) is incorrect regarding group 13 elements. Its the correct form is, orthoboric acid is a weak monobasic acid.

Question10

Which of the following statements are correct?

(I) SnF_4 is ionic in nature.

(II) Stability of dihalides of group 14 elements increases down the group.

(III) GeCl_2 is more stable than GeCl_4 .

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Options:

A.

I, II and III

B.

I and III only



C.

II and III only

D.

I and II only

Answer: D

Solution:

Statement I and II are true, while III is incorrect.

The correct form of statement III is, GeCl_2 is less stable than GeCl_4 .

Question 11

Nature of two oxides of nitrogen X and Y formed in the reaction of sodium nitrite with hydrochloric acid is

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Options:

A.

Both X and Y are acidic in nature

B.

X is acidic and Y is neutral in nature

C.

Both X and Y are neutral in nature

D.

X is amphoteric and Y is neutral in nature

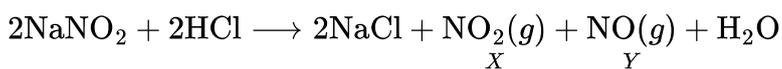
Answer: B

Solution:



When sodium nitrate react with HCl , two nitrogen oxide (nitrogen dioxide (NO₂) and nitric oxide (NO)] are formed. NO₂ is acid and NO is neutral.

The complete reaction is,



Question12

Identify the reaction in which diborane is produced on industrial scale?

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Options:

A.

Reaction of BF₃ with LiAlH₄ in diethyl ether

B.

Oxidation of NaBH₄ with I₂

C.

Reaction of BF₃ with NaH at 450 K

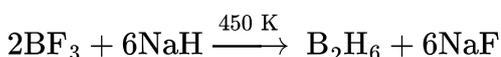
D.

By heating H₃BO₃ to above 370 K temperature

Answer: C

Solution:

The correct reaction to produce diborane on industrial scale is, Reaction of BF₃ with NaH at 450 K The reaction involved is,



Question13

Which of the following is not correct?

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Options:

A.

Thermal stability: $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se} > \text{H}_2\text{Te} > \text{H}_2\text{PO}$

B.

Reducing property: $\text{H}_2\text{S} > \text{H}_2\text{Se} > \text{H}_2\text{Te} > \text{H}_2\text{Po}$

C.

Boiling point : $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{O}$

D.

Melting point : $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{O}$

Answer: B

Solution:

The reducing property is incorrectly ordered.

The correct order is, $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$ Reducing strength increases down the group in chalcogen due to decreasing bond dissociation enthalpy.

Question14

Consider the following.

Statement I : Al_2O_3 is amphoteric in nature.

Statement II : Tl_2O_3 is more basic than Ga_2O_3 . The correct answer is



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Options:

A.

Both Statement I and Statement II are correct.

B.

Both Statement I and Statement II are not correct.

C.

Statement I is correct, but Statement II is not correct.

D.

Statement I is not correct, but Statement II is correct.

Answer: A

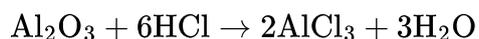
Solution:

Statement I:

Al_2O_3 is amphoteric in nature.

- **Explanation:**

Aluminum oxide reacts **both with acids and with bases**, forming salts in each case.



Hence, **aluminum oxide is amphoteric.**

So, **Statement I is correct.**

Statement II:

Tl_2O_3 is more basic than Ga_2O_3 .

We are comparing **Group 13 element oxides**:



→ **Trend:** From **B to Tl**, metallic character increases, so **basic character of oxides increases** (acidic → amphoteric → basic).

Thus, Tl_2O_3 (**Thallium(III) oxide**) is **more basic** than Ga_2O_3 (**Gallium oxide**).

So, **Statement II is also correct.**

✔ Final Answer:

Option A: Both Statement I and Statement II are correct.

Question15

White phosphorus on heating with concentrated NaOH solution in an inert atmosphere of CO₂ gives a salt 'X' and gas 'Y'. The oxidation state of central atom in X and Y is respectively

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Options:

A.

-3, +1

B.

+1, -3

C.

0, -3

D.

+1, +2

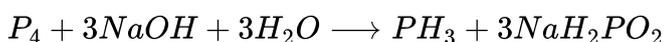
Answer: B

Solution:

When white phosphorus (P₄) is heated with concentrated NaOH solution in an inert atmosphere of CO₂, we are told it gives a salt 'X' and a gas 'Y'.

Step 1: Recall the known reaction

White phosphorus reacts with hot concentrated NaOH (and no oxygen) to produce phosphine gas (PH₃) and sodium hypophosphite (NaH₂PO₂) as the salt:



Step 2: Identify 'X' and 'Y'

- Salt $X = \text{NaH}_2\text{PO}_2$ (sodium hypophosphite)
- Gas $Y = \text{PH}_3$ (phosphine)

Step 3: Find oxidation states of phosphorus in each

For $X = \text{NaH}_2\text{PO}_2$

Let oxidation state of P = x .

$$(+1) + 2(+1) + x + 2(-2) = 0$$

$$1 + 2 + x - 4 = 0$$

$$x = +1$$

So in NaH_2PO_2 , P has oxidation state +1.

For $Y = \text{PH}_3$

Let oxidation state of P = x .

$$x + 3(+1) = 0$$

$$x = -3$$

Thus, in PH_3 , P has oxidation state -3 .

Answer:

Oxidation state of central atom in X and Y are respectively:

+1 and -3

Correct option: (B) +1, -3

Question16

The incorrect statement from the following is

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Options:

A.

Aluminium dissolves in conc. HNO_3 and liberates H_2 gas

B.

Borazole contains 12σ and 3π bonds

C.

Gallium oxide is amphoteric in nature

D.

BF_3 is a Lewis acid

Answer: A

Solution:

Statement given in option (a) is incorrect and its correct form is, when aluminium reacts with conc. HNO_3 , it forms a protective oxide layer on surface.

Question 17

In Buckminster fullerene, the number of six membered carbon rings is ' x ' and five membered carbon rings is ' y '. $(x + y)$ value is

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Options:

A.

30

B.

31

C.

32

D.

33

Answer: C

Solution:



In buckminster fullerene (C_{60}), there are 20 six member rings (X) and 12 five member rings (Y) are present. $X + Y = 20 + 12 = 32$

Question18

Which of the following is not correct?

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Options:

- A.
Potassium permanganate on heating gives potassium manganate and manganese dioxide only
- B.
Phosphine is used in smoke screens
- C.
Bleaching action of chlorine is due to oxidation
- D.
Noble gases have very low boiling points

Answer: A

Solution:

Among given, statement (a) is incorrect. It's correct form is, On heating potassium permanganate, it produces.

Potassium manganate, manganese oxide and oxygen gas



Question19

In the structure of diborane, the number of 2-centre-2-electron bonds is X and 3-centre-2-electron bonds is Y . The value of $(X + Y)$ is

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Options:

A.

5

B.

6

C.

4

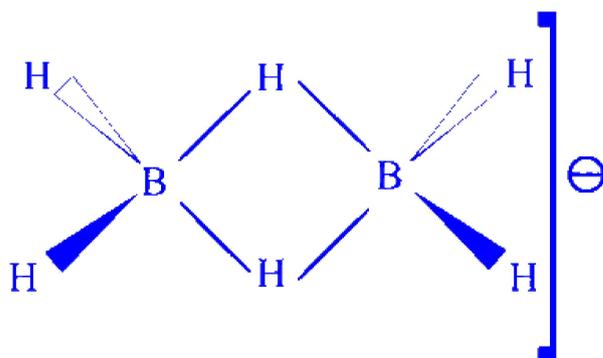
D.

8

Answer: B

Solution:

Diborane : B_2H_6



There are four terminal B – H bonds. These are 2-center-2-electron bonds Thus $X = 4$.

There are two bridging B – H – B bonds. These are 3-centre-2-electron bonds.
 $Y = 2 \Rightarrow X + Y = 4 + 2 = 6$



Question20

The oxides of nitrogen obtained by the reaction of nitric acid with (i) P_4O_{10} (ii) P_4 respectively are

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Options:

A.

NO, N_2O

B.

N_2O_3 , NO

C.

N_2O_5 , NO_2

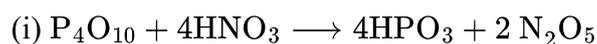
D.

NO_2 , N_2O

Answer: C

Solution:

The complete reaction is as follows



Hence, oxides are N_2O_5 and NO_2 .

Question21

Consider the following -

Statement I : The order of electronegativity of B, Al, In Tl is $B > Tl > Al > In$

Statement II : Boric acid is a weak protonic acid.

The correct answer is

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Options:

A.

Both Statement-I and Statement-II are correct.

B.

Both Statement-I and Statement-II are not correct.

C.

Statement-I is correct, but Statement-II is not correct.

D.

Statement-I is not correct, but Statement-II is correct.

Answer: B

Solution:

Both statement I and statement II are incorrect. Their correct form are The order of electronegativity is

$B > Tl > In > Al$

Boric acid is not a protonic acid, because it does not donate (H^+)proton, it accept a lone pair of electrons from water.

Question22

Which of the following does not exist?

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Options:

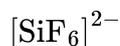
A.



B.



C.



D.



Answer: A

Solution:

$[\text{SiCl}_6]^{2-}$ does not exist.

This is due to the larger size of Cl atom, which make it difficult for six chloride ions to be accommodated around the relatively small silicon ions leading to steric hindrance and instability.

Question23

Gas X is obtained in Deacon's process. X on reacting with iodine and water gives

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Options:

A.



B.

HIO₂

C.

HIO

D.

HIO₃

Answer: D

Solution:

The complete reaction is as follows,

Deacon's process



Question24

Identify the correct sets

(i) Boron fibres - bullet proof vest

(ii) Metal borides - protective shields

(iii) Borax - glass wool

Correct option is

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Options:

A. i, ii only

B. i, ii, iii

C. i, iii only

D. ii, iii only

Answer: D

Solution:

The correct pair is (ii) and (iii) only.

- Boron fibres are used in high-stiffness, high-strength composites (e.g. aerospace), not in bullet-proof vests.
- Metal borides (e.g. TiB_2 , ZrB_2) are extremely hard and find use in protective shields/armor.
- Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$) provides B_2O_3 in glass formulations and is a key ingredient in glass wool.

Answer: Option D (ii, iii only).

Question25

Hydrolysis of XeF_4 gives HF, O_2 , Xe and ' X '. The structure of ' X ' is

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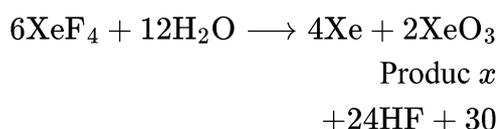
Options:

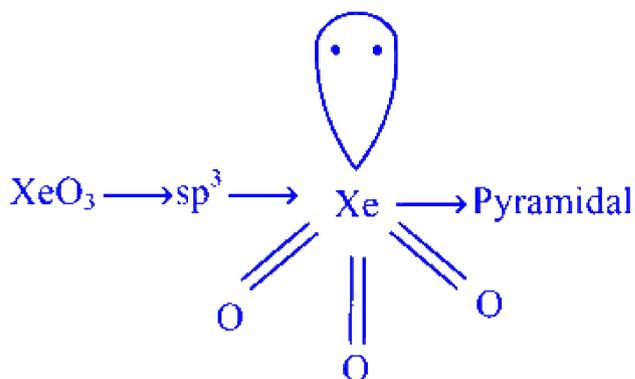
- A. pyramidal
- B. square pyramidal
- C. octahedral
- D. square planar

Answer: A

Solution:

XeF_4 violently reacts with water and gives following.





Question 26

Two statements are given below.

Statement I : SnF_4 , PbF_4 are ionic in nature.

Statement II : GeCl_2 is more stable than GeCl_4

The correct answer is

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Options:

- A. Both Statements I and II are correct.
- B. Both Statements I and II are not correct.
- C. Statement I is correct but Statement II is not correct.
- D. Statement I is not correct but Statement II is correct.

Answer: C

Solution:

Statement I is correct, while Statement II is not correct.

For clarification, GeCl_4 is more stable than GeCl_2 . This is because, in GeCl_4 , germanium is in the +4 oxidation state, which is more stable than the +2 state, primarily due to the inert pair effect.

Question27

In which of the following sets allotropes of carbon are correctly matched with their uses?

i. Graphite - Crucibles

ii. Activated charcoal - Water filters

iii. Carbon black - Fuel

The correct answer is

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Options:

A. i, iii only

B. ii, iii only

C. i , ii and iii

D. i, ii only

Answer: D

Solution:

The explanation provides information on the uses of certain carbon allotropes:

Graphite - Crucibles:

This statement is correct. Graphite's high melting point and stability make it ideal for use in crucibles, which are containers used to heat substances to very high temperatures.

Activated Charcoal - Water filters:

This statement is also correct. Activated charcoal is commonly used in water filters due to its ability to absorb impurities and contaminants.

Carbon Black - Fuel:



This statement is incorrect. Carbon black is not used as a fuel. Instead, it is obtained as soot from the incomplete combustion of carbon-rich fuels. It is primarily used to strengthen rubber in tires, as well as in various pigments and coatings.

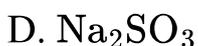
Therefore, the correct matches for the uses of carbon allotropes are in statements (i) and (ii).

Question28

Two of the products formed by the reaction of ' X ' with HCl are gases. What is ' X '?

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Options:

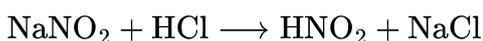


Answer: A

Solution:

The reaction between sodium nitrite (NaNO_2) and hydrochloric acid (HCl) proceeds as follows:

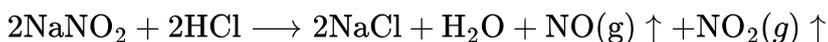
First, sodium nitrite reacts with hydrochloric acid to form nitrous acid (HNO_2) and sodium chloride (NaCl):



However, HNO_2 is unstable and decomposes further:



Overall, the balanced reaction is:



In this reaction, two gaseous products, nitric oxide (NO) and nitrogen dioxide (NO_2), are formed.



Question29

Hydrated sodium aluminium silicate is called
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Options:

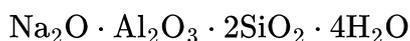
- A. calgon
- B. zeolite
- C. dead burnt plaster
- D. kaolinite

Answer: B

Solution:

Hydrated sodium aluminium silicate is known as zeolite.

Chemical Formula:



Zeolites are microporous, aluminosilicate minerals commonly used as commercial adsorbents and catalysts.

Question30

Which of the allotropic forms of carbon is aromatic in nature?

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Options:

- A. Diamond
- B. Graphite
- C. Buckminster fullerene
- D. Coke

Answer: C

Solution:



Buckminster fullerene is an allotrope of carbon known for its aromatic nature.

Question31



X, Y are oxoacids of phosphorous. The number of P – OH bonds in X, Y respectively is



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Options:

A. 1,4

B. 4, 1

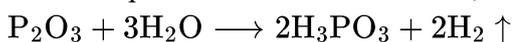
C. 2,4

D. 1,1

Answer: C

Solution:

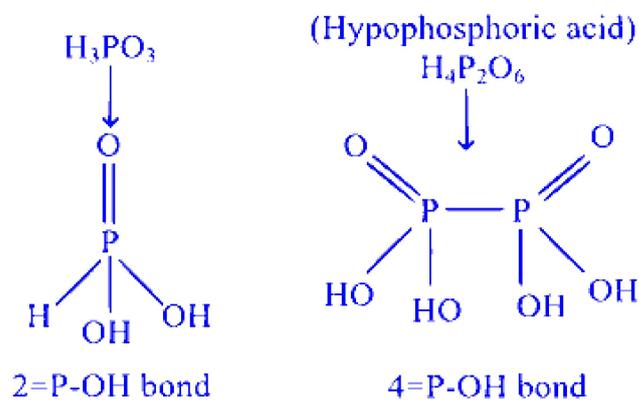
The complete reaction is as follows,



Product X

(Phosphorous acid)





Question32

A Lewis acid 'X' reacts with LiAlH_4 in ether medium to give a highly toxic gas. 'Y', 'Y' when heated with NH_3 gives a compound known as inorganic benzene. 'Y' burns in oxygen and gives H_2O and 'Z', 'Z' is

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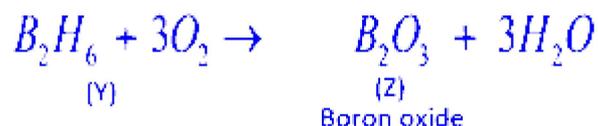
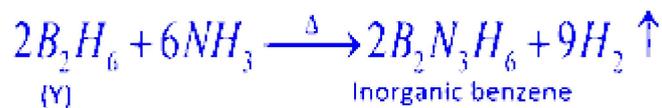
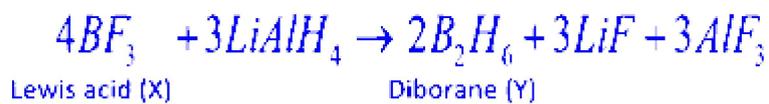
Options:

- A. basic oxide
- B. acidic oxide
- C. amphoteric acid
- D. neutral oxide

Answer: B

Solution:

The complete reaction is as follows,



Question33

Which of the following are correct?

- i. Basic structural unit of silicates is $-R_2SiO-$
- ii. Silicones are biocompatible
- iii. Producer gas contains CO and N_2

The correct option is

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Options:

- A. i, ii, iii
- B. ii, iii only
- C. i, iii only
- D. i, ii only

Answer: B

Solution:

Let's examine each statement:

Statement i: "Basic structural unit of silicates is $-R_2SiO-$ "

The basic building block of silicates is actually the SiO_4^{4-} tetrahedron. The unit $-R_2SiO-$ is representative of silicones (or polysiloxanes), where R is an organic group. In silicates, there is no organic R group.

Therefore, statement i is incorrect.

Statement ii: "Silicones are biocompatible"

Silicones are known for their excellent biocompatibility and are widely used in medical implants, devices, and other applications where interacting with biological tissues is required.

This statement is correct.

Statement iii: "Producer gas contains CO and N_2 "

Producer gas is produced by the partial combustion of carbonaceous materials in air. Its primary components include carbon monoxide (CO), hydrogen (H_2), carbon dioxide (CO_2), and nitrogen (N_2).

This statement is also correct.

Since only statements ii and iii are correct, the correct option is:

Option B: ii, iii only.

Question34

' X ' on hydrolysis gives two products. One of them is solid. What is ' X '?

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Options:

A. P_4O_{10}

B. F_2

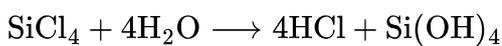
C. $SiCl_4$

D. N^{3-}

Answer: C

Solution:

$SiCl_4$ on hydrolysis gives HCl and $Si(OH)_4$ which is solid. The complete reaction is



(X)

(Solid)

Question35

Which of the following reactions give phosphine?

i. Reaction of calcium phosphide with water

ii. Heating white phosphorous with concentrated NaOH solution in inert atmosphere

iii. Heating red phosphorous with alkali

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Options:

A. i, ii, only

B. i, ii, iii

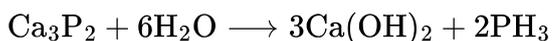
C. ii, iii only

D. i, iii only

Answer: A

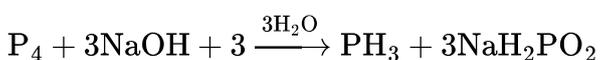
Solution:

Reaction of calcium phosphide with water gives phosphine.



Phosphine

Heating white phosphorous with conc. NaOH solution in inert atmosphere also gives phosphine.



Question36

Observe the following stoichiometric equation



What is the conjugate acid of x^- ?

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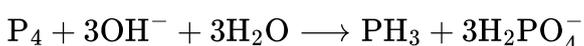
Options:

- A. Phosphorous acid
- B. Hypophosphorous acid
- C. Phosphoric acid
- D. Pyrophosphoric acid

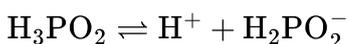
Answer: B

Solution:

The complete reaction is as follows,



Here, x is H_2PO_2^- . The conjugate acid of x is hypophosphorus acid.



Question37

Identify the correct statements

- i. Oxidation of NaBH_4 with I_2 gives B_2H_6
- ii. B_2H_6 burns in oxygen and releases an enormous amount of energy

iii. B_2H_6 on hydrolysis gives a tribasic acid

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Options:

A. i, ii, iii

B. i, iii, only

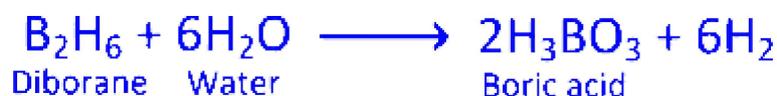
C. i, ii, only

D. ii, iii only

Answer: C

Solution:

Statement given in Eqs. (i) and (ii) are correct, while (iii) is incorrect. It's correct form is



Boric acid is monobasic acid in water.

Question38

The disproportionation products of ortho phosphorus acid are

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Options:

A. H_3PO_4 , PH_3

B. H_3PO_2 , H_3PO_3

C. H_3PO_4 , HPO_3

D. H_3PO_2 , P_2H_4

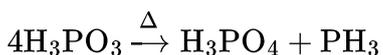
Answer: A



Solution:

Disproportionation is a type of redox reaction in which an element undergoes both oxidation and reduction to form two different compounds.

The disproportionation reaction for orthophosphorus acid is:



In this reaction:

Orthophosphorus acid (H_3PO_3) is initially at a +3 oxidation state.

It gets oxidized to phosphoric acid (H_3PO_4), where phosphorus is at a +5 oxidation state.

Simultaneously, it is reduced to phosphine (PH_3), where phosphorus is at a -3 oxidation state.

Question39

Aluminium carbide on reaction with D_2O gives $\text{Al}(\text{OD})_3$ and 'X'. What is 'X'?

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Options:

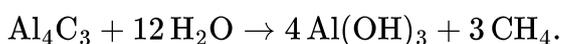


Answer: D

Solution:

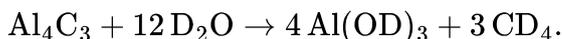
Let's look at the reaction step by step.

Aluminium carbide, typically represented as Al_4C_3 , reacts with water to produce aluminium hydroxide and methane. The balanced reaction with H_2O is:



When deuterium oxide (D_2O) is used instead of water, every hydrogen atom is replaced by deuterium. Hence, aluminium hydroxide becomes aluminium deuterioxide, $\text{Al}(\text{OD})_3$, and methane becomes fully deuterated methane, CD_4 .

The modified reaction becomes:



So, the product X' in the reaction is CD_4 .

Thus, the correct answer is Option D: CD_4 .

Question40

When chlorine reacts with hot and conc. NaOH . The products formed are

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Options:



Answer: A

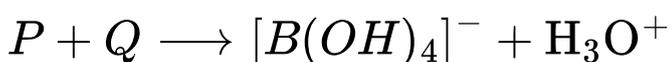
Solution:

When chlorine is reacted with hot concentrated NaOH solution, the products are sodium chloride (NaCl), sodium chlorate (NaClO_3) and water (H_2O).



Question41

Identify the P and Q of the following reaction

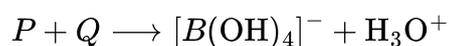


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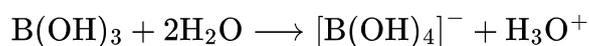
Options:**Answer: B****Solution:**

Here's the reaction we need to identify P and Q for:



Explanation:

The balanced reaction is:

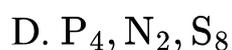
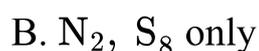
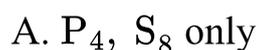


This means that $P = \text{H}_3\text{BO}_3$ and $Q = 2\text{H}_2\text{O}$. In this reaction, H_3BO_3 acts as a Lewis acid.

Question42

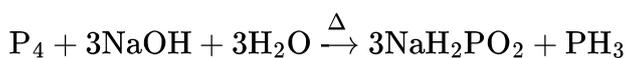
Among P_4 , S_8 and N_2 the elements which undergo disproportionation when heated with NaOH solution.

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Options:**Answer: A**

Solution:

P_4 reacts with NaOH. On heating, it gives NaH_2PO_2 and PH_3 .



This reaction is a disproportionation reaction as oxidation state of P changes from 0 to +1 and -3 . Which implies that, it undergoes oxidation and reduction simultaneously.

S_8 reacts with NaOH on heating to give Na_2S and $Na_2S_2O_3$.

This reaction is a disproportionation reaction as oxidation state of S changes from 0 to -2 and $+2$. Which implies that, it undergoes oxidation and reduction simultaneously. But, N_2 is an inert gas. So, it does not react with NaOH. Thus, only P_4 and S_8 undergo disproportionation when heated with NaOH solution.

Question 43

Identify the correct statements about the anomalous behaviour of boron.

I. Boron trihalides can form dimeric structures.

II. Boron shows +1 as stable oxidation state.

III. Maximum covalency of boron is four.

IV. Boron does not form BF_6^{6-} ion.

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Options:

A. I, II only

B. II, III only

C. III, IV only

D. I, IV only

Answer: C

Solution:

(I) Size of boron atom is very small, so it cannot accommodate 4 large halide atoms and thus, does not form dimer. Also, the electron deficiency of boron is removed by $p\pi - p\pi$ back-bonding. Hence, the boron trihalides do not form dimers.

(II) In boron family, as we move down the group, two oxidation states are shown by them, i.e. +1 and +3. However, boron shows only +3 oxidation state because of the absence of inert pair effect. Boron does not show +1 oxidation state.

(III) Boron shows a maximum covalency of four because of absent of d -orbitals.

(IV) Boron does not form BF_6^{3-} ion because of absence of empty d -orbitals.

Hence, only statements III and IV are correct.

Question44

Which of the following is formed when SO_3 is absorbed by concentrated H_2SO_4 ?

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Options:



Answer: C

Solution:

When SO_3 gas is passed through H_2SO_4 solution, it get absorbed in concentrated H_2SO_4 . The final product formed here is oleum or fuming sulphuric acid.



Question45

Identify the correct statements about boron.

I. It has high melting point.

II. It has high density.

III. It has high electrical conductivity.

IV. B-10 isotope of it has high ability to absorb neutrons.

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Options:

A. I and II only

B. II and III only

C. III and IV only

D. I and IV only

Answer: D

Solution:

I. Boron has a high melting point of 2352 K . So, statement I is correct.

II. Boron has a low density of 2.37 gcm^{-3} . So, statement II is incorrect.

III. Boron has low electrical conductivity at low temperature. So, statement III is incorrect.

IV. B-10 isotope is a neutron absorber due to the high neutron cross-section of isotope ^{10}B . So, statement IV is also correct. Hence, statements I and IV are correct.

Question46

Assertion (A) HCl gas is dried by passing through concentrated H_2SO_4 .



Reason (R) HCl gas reacts with NH₃ that gives white fumes.

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Options:

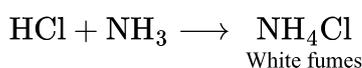
- A. Both A and R are correct and R is the correct explanation of A.
- B. Both A and R are correct and R is not the correct explanation of A.
- C. A is correct but R is incorrect.
- D. A is incorrect but R is correct.

Answer: B

Solution:

HCl gas is dried by passing through the drying agent i.e. concentrated sulphuric acid. So, assertion is correct.

HCl reacts with NH₃ to give white fumes of ammonium chloride.



So, reason is also correct. But reason is not a correct explanation of assertion.

Question47

H₃BO₃ or B(OH)₃ is considered as an acid because its molecule

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Options:

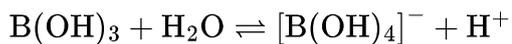
- A. combines with proton from water molecule
- B. accepts OH⁻ from water, releasing a proton
- C. contains replaceable H⁺ ion

D. can donate proton easily

Answer: B

Solution:

Boric acid (H_3BO_3) is an acid because its molecule accepts OH^- from water releasing proton.



Question48

Xenon best reacts with

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Options:

- A. neutral atoms
- B. most electronegative elements
- C. most electropositive elements
- D. transition elements

Answer: B

Solution:

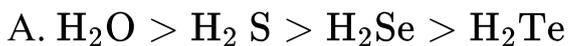
As Xe has fully filled stable electronic configuration, it will react only with most electronegative elements like O and F. Xenon (Xe) reacts with fluorine to form XeF_2 , XeF_4 and XeF_6 .

Question49

The correct order of acidic character of the following is

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Options:



Answer: C

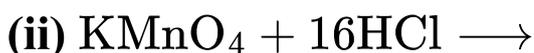
Solution:

Acidity of hydrides increases down the group because of decrease in bond dissociation enthalpy.



Question 50

In the following reactions (i) and (ii), the number of moles of chlorine gas released respectively are



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Options:

A. 1 and 4

B. 1 and 5

C. 2 and 5

D. 2 and 4

Answer: B



Solution:

(i) $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2(g)$ 1 mole of chlorine gas released.

(ii) $2\text{KMnO}_4 + 16\text{HCl} \longrightarrow$
 $2\text{KCl} + 2\text{MnCl}_2 + 8\text{H}_2\text{O} + 5\text{Cl}_2$

5 moles of chlorine gas released.

Question51

What would be the product of following reaction?

$\text{SiCl}_4 \xrightarrow{\text{Excess of H}_2\text{O}}$? (Major product)

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Options:

A. $\text{SiCl}_3(\text{OH})$

B. $\text{Si}(\text{OH})_4$

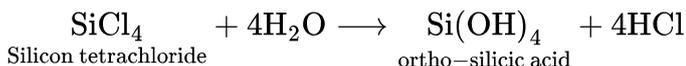
C. $\text{SiCl}_2(\text{OH})_2$

D. SiCl_4 (no reaction)

Answer: B

Solution:

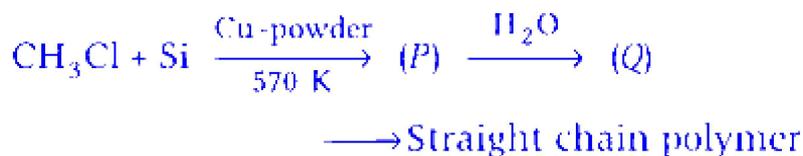
Silicon tetrachloride react with water to produce ortho silicic acid and hydrogen chloride.



Question52

Identify (P) and (Q) in the following reaction.





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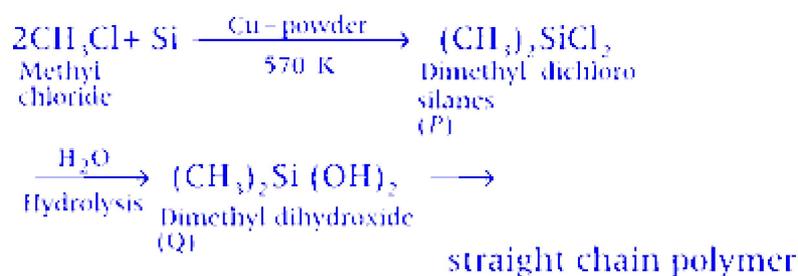
Options:

- A. $P : (\text{CH}_3)_3\text{SiCl}$, $Q : (\text{CH}_3)_3\text{SiOH}$
- B. $P : (\text{CH}_3)_2\text{SiCl}_2$, $Q : (\text{CH}_3)_2\text{Si}(\text{OH})_2$
- C. $P : (\text{CH}_3)_2\text{SiCl}_2$, $Q : (\text{CH}_3)_2\text{Si}(\text{OH})\text{Cl}$
- D. $P : (\text{CH}_3)_2\text{SiCl}_2$, $Q : (\text{CH}_3)_2\text{SiO}$

Answer: B

Solution:

Silicon is heated with methyl chloride at high temperature in the presence of Cu- powder at 570 K, methyl substituted chlorosilanes MeSiCl_3 , Me_2SiCl_2 , Me_3SiCl and Me_4Si are formed. After formation of Me_2SiCl_2 , H_2O is used for hydrolysis to form $(\text{CH}_3)_2\text{Si}(\text{OH})_2$ i.e. Q . Hence, Q is straight chain polymer



Question 53

Match the following compounds with their corresponding physical properties.

	Column I		Column II
A.	IBr	1.	Orange solid
B.	ClF ₃	2.	Yellow-green liquid

	Column I		Column II
C.	BrF_3	3.	Black solid
D.	ICl_3	4.	Colourless gas

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Options:

A. A - 2, B - 1, C - 4, D - 3

B. A - 1, B - 3, C - 2, D - 4

C. A - 3, B - 4, C - 2, D - 1

D. A - 4, B - 2, C - 1, D - 3

Answer: C

Solution:

(a) IBr is an interhalogen compound with the chemical symbol IBr . It is a black solid that melts near room temperature. It is used for iodometry.

(b) ClF_3 is an interhalogen compound. This is colourless, poisonous, corrosive and extremely reactive gas. It condenses to a pale-greenish/yellow liquid, the form in which it is most often sold.

(c) BrF_3 is also an interhalogen compound. It is yellow-green liquid with a pungent odor. It is soluble in sulphuric acid but reacts violently with water.

(d) ICl_3 is an interhalogen compound of iodine and chlorine. It is bright yellow-orange solid but on exposure to light it turns red.

