P Block Elements

Question1

Match List-I with List-II :

List-I (Oxoacids of Sulphur)	List-II (Bonds)
A. Peroxodisulphuric acid	I. Two S – OH, Four S = O, One S – O – S
B. Sulphuric acid	II. Two S – OH, One S = O
C. Pyrosulphuric acid	III. Two S – OH, Four S = O, One S – O – O – S
D. Sulphurous acid	IV. Two S – OH, Two S = O

Choose the correct answer from the options given below.

[NEET 2023]

Options:

A.

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

B.

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

C.

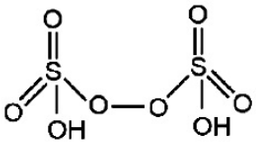
A-III, B-IV, C-II, D-I

D.

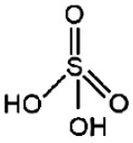
A-I, B-III, C-II, D-IV

Answer: A

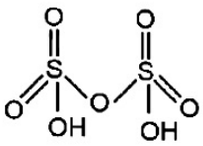
Solution:



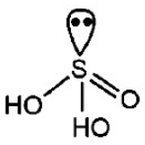
Peroxodisulphuric acid
($H_2S_2O_8$)



Sulphuric acid
(H_2SO_4)



Pyrosulphuric acid
($H_2S_2O_7$)



Sulphurous acid
(H_2SO_3)

Question2

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Helium is used to dilute oxygen in diving apparatus.
Reason R : Helium has high solubility in O_2.
In the light of the above statements, choose the correct answer from the options given below

[NEET 2023]

Options:

A.

Both A and R are true and R is NOT the correct explanation of A

B.

A is true but R is false

C.

A is false but R is true

D.

Both A and R are true and R correct explanation of A

Answer: A

Solution:

Solution:

Helium is used as diluent for oxygen in modern diving apparatus because of its very low solubility in blood.

Gases diffuses easily with each other.

Question3

Given below are two statements: one is labelled as Assertion(A) and the

other is labelled as Reason (R).
Assertion (A) : ICl is more reactive than I_2.
Reason (R): I-CI bond is weaker than I-I bond.
In the light of the above statements, choose the most appropriate answer from the options given below:
[NEET-2022]

Options:

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. (A) is correct but (R) is not correct

D. (A) is not correct but (R) is correct

Answer: A

Solution:

Solution

In general, interhalogen compounds are more reactive than halogens (except fluorine). This is because $X-X^{'}$ bond in interhalogens is weaker than $X-X$ bond in halogens excepts $F-F$ bond. Therefore $I-Cl$ is more reactive than I_2 because of weaker $I-Cl$ bond then $I-I$ bond.

Question4

Given below are two statements Statement I The boiling points of the following hydrides of group 16 elements increases in the order - $H_2O < H_2S < H_2Se < H_2Te$
Statement II The boiling points of these hydrides increase with increase in molar mass.
In the light of the above statements, choose the most appropriate answer from the options given below :
[NEET-2022]

Options:

A. Both Statement I and Statement II are correct

B. Both Statement I and Statement II are incorrect

C. Statement I is correct but Statement II is incorrect

D. Statement I is incorrect but Statement II is correct

Answer: B

Solution:

Compound	Boiling point (K)
H_2O	373
H_2S	213
H_2Se	232
H_2Te	269

- The boiling points of these hybrids not exactly increases with increase in molar mass.

- H_2O has maximum boiling point due to intermolecular hydrogen bonding.

Question5

Which of the following reactions is a part of the large scale industrial preparation of nitric acid [NEET Re-2022]

Options:

A. $Cu(NO_3)_2 + 2NO_2 + 2H_2O \xrightarrow[500K,\ 9\ bar]{Pt} 4HNO_3 + Cu$

B. $NaNO_3 + H_2SO_4 \xrightarrow[500K,\ 9\ bar]{Pt} NaHSO_4 + HNO_3$

C. $4NH_3 + 5O_2(\text{from air}) \xrightarrow[500K,\ 9\,bar]{Pt} 4\,NO + 6H_2O$

D. $4HPO_3 + 2N_2O_5 \xrightarrow[500K,\ 9\,bar]{Pt} 4HNO_3 + P_4O_{10}$

Answer: C

Solution:

On large scale, nitric acid is prepared by Ostwald's process.

$$(i) 4NH_{3(g)} + \underset{(\text{air})_2}{5O} \xrightarrow[500K,\ 9\ bar]{Pt/Rh\ \text{gauge}} 4NO_{(g)} + 6H_2O_{(g)}$$

$$(ii)\ 2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$$

$$(iii)\ 3NO_{2(g)} + H_2O_{(\ell)} \rightarrow 2HNO_{3(\text{aq})} + NO$$

Question6

Flourine is a stronger oxidising agent than chlorine because:
(a) F-F bond has a low enthalpy of dissociation.
(b) Flouride ion (F^-)has high hydration enthalpy.

(c) Electron gain enthalpy of flourine is less negative than chlorine.
(d) Flourine has a very small size.
Choose the most appropriate answer from the options given:
[NEET Re-2022]

Options:

A. (b) and (c) only

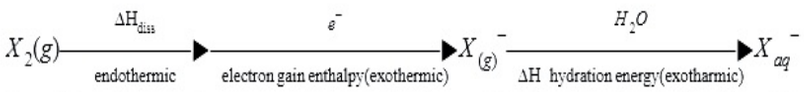
B. (a) and (b) only

C. (a) and (c) only

D. (a) and (d) only

Answer: B

Solution:



By adding these values more energy isreleased for fluorine due to low bonddissociation enthalpy and high hydrationenthalpy.

Question7

Noble gases are named because of their inertness towards reactivity.
Identify an incorrect statement about them.
[NEET 2021]

Options:

A. Noble gases are sparingly soluble in water

B. Noble gases have very high melting and boiling points

C. Noble gases have weak dispersion forces

D. Noble gases have large positive values of electron gain enthalpy

Answer: B

Solution:

Noble gases have weak dispersion forces hence they have low melting and boiling points.

Question8

Statement I : Acid strength increases in the order given as HF << HCl << HBr << HI.

Statement II : As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.
In the light of the above statements, choose the correct answer from the options given below.
[NEET 2021]

Options:

A. Both statement I and Statement II are true

B. Both Statement I and Statement II are false

C. Statement I is correct but statement II is false

D. Statement I is incorrect but Statement II is true

Answer: A

Solution:

In the modern periodic table, moving down the group as the size of halogen atom increases, the H – X bond length also increases as a result the bond enthalpy decreases. Hence, The acidic strength also increases.
So, the correct order of acidic strength is
HI > HBr > HCl > HF

Question9

Urea reacts with water to form A which will decompose to form B. B when passed through Cu^{2+} (aq), deep blue colour solution C is formed. What is the formula of C from the following?
(2020)

Options:

A. $[Cu(NH_3)_4]^{2+}$

B. $Cu(OH)_2$

C. $CuCO_3Cu(OH)_2$

D. $CuSO_4$

Answer: A

Solution:

$$NH_2CONH_2 + H_2O \longrightarrow \underset{(A)}{(NH_4)_2CO_3} \xrightarrow{\Delta} \underset{(B)}{NH_3}(g) + CO_3(g) + H_3O(l)$$

$$\underset{(B)}{NH_3}(g) \xrightarrow{Cu^{2+}(aq)} \underset{(C)}{[Cu(NH_3)_4]^{2+}}$$

Blue coloured solution

Question10

Which is the correct thermal stability order for H_2E (E = O, S, Se, Te and Po)? (NEET 2019)

Options:

A. $H_2Se < H_2Te < H_2Po < H_2O < H_2S$

B. $H_2S < H_2O < H_2Se < H_2Te < H_2Po$

C. $H_2O < H_2S < H_2Se < H_2Te < H_2Po$

D. $H_2Po < H_2Te < H_2Se < H_2S < H_2O$

Answer: D

Solution:

Solution:
The thermal stability of hydrides decreases from H_2O to H_2Po. This is because as the size of atom E in H_2E increases, the bond $H-E$ becomes weaker and thus breaks on heating. Therefore, the correct order of thermal stability is $H_2Po < H_2Te < H_2Se < H_2S < H_2O$

Question11

Match the Xenon compounds in Column-I with its structure in Column-II and assign the correct code.

Column-I	Column-II
(A) XeF_4	(i) pyramidal
(B) XeF_6	(ii) square planar
(C) $XeOF_4$	(iii) distorted octahedral
(D) XeO_3	(iv) square pyramidal

(NEET 2019)

Options:

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

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

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

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

Answer: C

Question12

Which of the following oxoacid of sulphur has $-O-O-$ linkage? [2020]

Options:

A. H_2SO_4, sulphuric acid

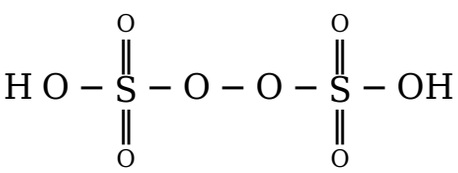
B. $H_2S_2O_8$, peroxodisulphuric acid

C. $H_2S_2O_7$, pyrosulphuric acid

D. H_2SO_3, sulphurous acid

Answer: B

Solution:



Peroxodisulphuric acid

Question13

Match the following:

(A) Pure nitrogen	(i) Chlorine
(B) Haber process	(ii) Sulphuric acid
(C) Contact process	(iii) Ammonia
(D) Deacon's process	(iv) Sodium azide or Barium azide

(NEET 2019)

Options:

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

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

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

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

Answer: A

Question14

Identify the incorrect statement related to PCl_5 from the following : (NEET 2019)

Options:

A. PCl_5, molecule is non-reactive.

B. Three equatorial $P-Cl$ bonds make an angle of $120°$ with each other.

C. Two axial $P-Cl$ bonds make an angle of $180°$ with each other.

D. Axial $P-Cl$ bonds are longer than equatorial $P-Cl$ bonds.

Answer: A

Solution:

Solution:
Due to longer and hence weaker axial bonds, PCl_5 is a reactive molecule.

Question15

A compound 'X' upon reaction with H_2O produces a colourless gas 'Y' with rotten fish smell. Gas 'Y' is absorbed in a solution of $CuSO_4$ to give Cu_3P_2 as one of the products. Predict the compound 'X'.
(Odisha NEET 2019)

Options:

A. Ca_3P_2

B. NH_4Cl

C. As_2O_3

D. $Ca_3(PO_4)_2$

Answer: A

Solution:

$$\underset{(X)}{Ca_3P_2} + 6H_2O \rightarrow 3\,Ca(OH)_2 + \underset{(Y\{\text{Rotten fish smell}\})}{2PH_{3(g)}}$$

$$3CuSO_4 + \underset{(Y)}{2PH_3} \rightarrow \underset{(\text{Copper phosphide})}{Cu_3P_2} + 3H_2SO_4$$

Question16

Which of the following oxoacids of phosphorus has strongest reducing property?
(Odisha NEET 2019)

Options:

A. $H_4P_2O_7$

B. H_3PO_3

C. H_3PO_2

D. H_3PO_4

Answer: C

Solution:

Acids which contain $P-H$ bonds have strong reducing properties. Among the given compounds, H_3PO_2 is the strongest reducing agent as it contains two $P-H$ bonds.

Question17

Identify the correct formula of oleum from the following : (Odisha NEET 2019)

Options:

A. $H_2S_2O_7$

B. H_2SO_3

C. H_2SO_4

D. $H_2S_2O_8$

Answer: A

Question18

Which of the following statements is not true for halogens? (NEET 2018)

Options:

A. All form monobasic oxyacids.

B. All are oxidizing agents.

C. All but fluorine show positive oxidation states.

D. Chlorine has the highest electron-gain enthalpy.

Answer: C

Solution:

All halogens show both positive and negative oxidation states while fluorine shows only negative oxidation state except +1 in HOF.

Question19

Match the interhalogen compounds of column-I with the geometry in column-II and assign the correct code.

Column I	Column II
(A) XX'	(i) T-shape
(B) XX'_3	(ii) Pentagonal bipyramidal
(C) XX'_5	(iii) Linear
(D) XX'_7	(iv) Square pyramidal
	(v) Tetrahedral

(NEET 2017)

Options:

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

B. A-(v), B-(iv), C-(iii), D-(ii)

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

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

Answer: A

Question20

In which pair of ions both the species contain S − S bond?
(NEET 2017)

Options:

A. $S_4O_6^{2-}$, $S_2O_3^{2-}$

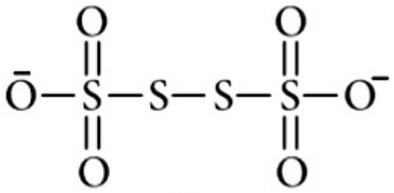
B. $S_2O_7^{2-}$, $S_2O_8^{2-}$

C. $S_4O_6^{2-}$, $S_2O_7^{2-}$

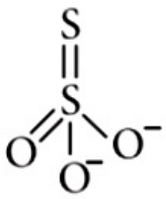
D. $S_2O_7^{2-}$, $S_2O_3^{2-}$

Answer: A

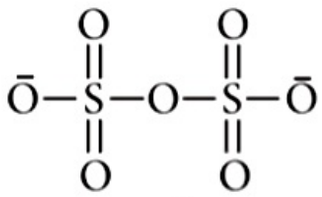
Solution:



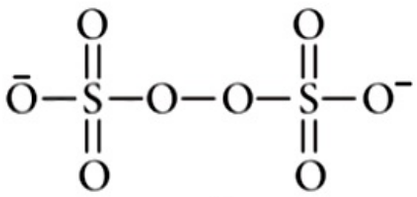
$(S_4O_6^{2-})$



$(S_2O_3^{2-})$



$(S_2O_7^{2-})$



$(S_2O_8^{2-})$

Question21

Match the compounds given in column I with the hybridisation and shape given in column II and mark the correct option.

Column I	Column II
(A)XeF_6	(i) distorted octahedral
(B)XeO_3	(ii) square planar
(C)$XeOF_4$	(iii) pyramidal
(D)XeF_4	(iv) square pyramidal

(NEET-I 2016)

Options:

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

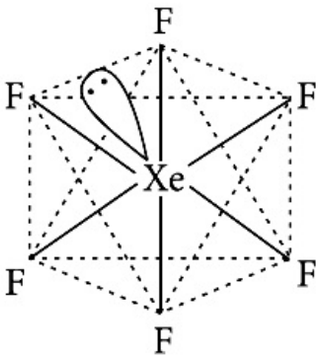
B. A-(iv), B-(i), C-(ii), D-(iii)

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

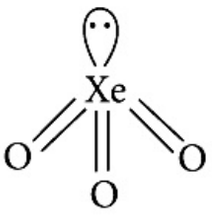
D. A-(i), B-(ii), C-(iv), D-(iii)

Answer: C

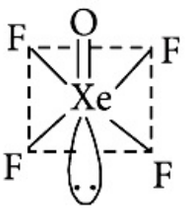
Solution:



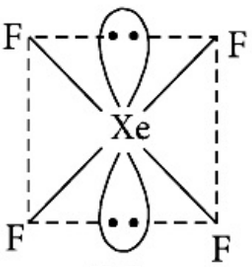
XeF_6
Distorted octahedral
sp^3d^3



XeO_3
Pyramidal
sp^3



$XeOF_4$
Square pyramidal
sp^3d^2



XeF_4
Square planar
sp^3d^2

Question22

Which is the correct statement for the given acids? (NEET-I 2016)

Options:

A. Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.

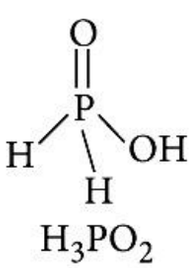
B. Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid.

C. Both are diprotic acids.

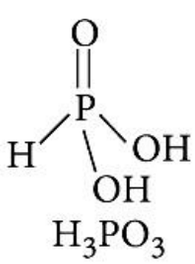
D. Both are triprotic acids.

Answer: A

Solution:



H_3PO_2
Hypophosphorous acid
or Phosphinic acid
(Monobasic)



H_3PO_3
Orthophosphorous acid
or Phosphonic acid
(Dibasic)

Question23

Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?
(NEET-I 2016)

Options:

A. $Br_2 > I_2 > F_2 > Cl_2$

B. $F_2 > Cl_2 > Br_2 > I_2$

C. $I_2 > Br_2 > Cl_2 > F_2$

D. $Cl_2 > Br_2 > F_2 > I_2$

Answer: D

Solution:

The order of bond dissociation enthalpy is : $Cl_2 > Br_2 > F_2 > I_2$

Bond dissociation energy of halogen family decreases down the group as the size of atom increases.
The decreasing order for the bond dissociation enthalpy of halogen moleculesis
$Cl_2 57 kcal / mol > Br_2 45.5 kcal / mol > F_2 38 kcal / mol > 35.6 kcal / mol\, I_2$.

A halogen molecule having larger atoms should have low dissociation energy and vice versa. Fluorine is an exception because of interelectronic repulsion is present in small atom fluorine.

Question24

When copper is heated with conc. HNO_3 it produces
(NEET-I 2016)

Options:

A. $Cu(NO_3)_2$, NO and NO_2

B. $Cu(NO_3)_2$ and N_2O

C. $Cu(NO_3)_2$ and NO_2

D. $Cu(NO_3)_2$ and NO

Answer: C

Solution:

$Cu + 4\ HNO_3(\text{ conc.}) \rightarrow Cu(NO_3)_2 + 2\ NO_2 + 2\ H_2O$

Question25

Among the following, the correct order of acidity is (NEET-I 2016, 2007, 2005)

Options:

A. $HClO_2 < HClO < HClO_3 < HClO_4$

B. $HClO_4 < HClO_2 < HClO < HClO_3$

C. $HClO_3 < HClO_4 < HClO_2 < HClO$

D. $HClO < HClO_2 < HClO_3 < HClO_4$

Answer: D

Solution:

15. (d) : The acidic character of the oxoacids increases with increase in oxidation number of the halogen atom i.e., $HClO < HClO_2 < HClO_3 < HClO_4$.
This can be explained on the basis of relative stability of the anions left after removal of a proton. since the stability of the anion decreases in the order : $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$, acid strength also decreases in the same order.

Question26

Strong reducing behaviour of H_3PO_2 is due to (2015)

Options:

A. high electron gain enthalpy of phosphorus

B. high oxidation state of phosphorus

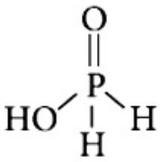
C. presence of two -OH groups and one P—H bond

D. presence of one -OH group and two P—H bonds.

Answer: D

Solution:

All oxyacids of phosphorus which have P—H bonds act as strong reducing agents. H_3PO_2 has two P—H bonds hence, it acts as a strong reducing agent.



Question27

The variation of the boiling points of the hydrogen halides is in the order HF > HI > HBr > HCl.
What explains the higher boiling point of hydrogen fluoride?
(2015)

Options:

A. There is strong hydrogen bonding between HF molecules.

B. The bond energy of HF molecules is greater than in other hydrogen halides

C. The effect of nuclear shielding is much reduced in fluorine which polarises the HF molecule

D. The electronegativity of fluorine is much higher than for other elements in the group.

Answer: A

Solution:

HF forms strong intermolecular H-bonding due to high electronegativity of F. Hence, the boiling point of HF is abnormally high. Boiling points of other hydrogen halides gradually increase from HCl to HI due to increase in size of halogen atoms from Cl to I which further increase the magnitude of van der Waals forces.

Question28

Which of the statements given below is incorrect?
(2015)

Options:

A. O_3 molecule is bent.

B. ONF is isoelectronic with O_2N^-

C. OF_2 is an oxide of fluorine

D. Cl_2O_7 is an anhydride of perchloric acid

Answer: C

Solution:

OF_2 (oxygen difluoride) is a fluoride of oxygen becaasc fluorine is more electronegative than oxygen.

Question29

The formation of the oxide ion, $O^2(g)$ from oxygen atom requires first an exothermic and then an endothermic step as shown below :
$O(g) + e^- \rightarrow O^-(g); \Delta_f H^\circ = -141\,kJ\,mol^{-1}$
$O^-(g) + e^- \rightarrow O^{2-}(g); \Delta_f H^\circ = +780\,kJ\,mol^{-1}$

Thus process of formation of O^{2-} in gas phase is unfavourable even though O^{2-} is isoelectronic with neon. It is due to the fact that,
(2015)

Options:

A. O^- ion has comparatively smaller size than oxygen atom

B. oxygen is more electronegative

C. addition of electron in oxygen results in larger size of the ion

D. electron repulsion outweighs the stability gained byachieving noble gas configuration.

Answer: D

Question30

Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds,but not by the other?
(2015 Cancelled)

Options:

A. Is soluble in water.

B. Is used as a food preservative

C. Forms ‘acid-rain’

D. Is a reducing agent.

Answer: B

Solution:

NO_2 is not used as a food preservative.

Question31

Acidity of diprotic acids in aqueous solutions increases in the order (2014)

Options:

A. $H_2S < H_2Se < H_2Te$

B. $H_2Se < H_2S < H_2Te$

C. $H_2Te < H_2S < H_2Se$

D. $H_2Se < H_2Te < H_2S$

Answer: A

Solution:

Solution:
As the atomic size increases down the group, the bond length increases and the bond strength decreases and the cleavage of E-H bond becomes easier thus, more will be the acidity. Thus, the correct order is: $H_2S < H_2Se < H_2Te$

Question32

Which is the strongest acid in the following? (2013 NEET)

Options:

A. $HClO_4$

B. H_2SO_3

C. H_2SO_4

D. $HClO_3$

Answer: A

Solution:

$H\overset{7}{Cl}O_4$ with highest oxidation number and its conjugate base is resonance stabilised, hence it is most acidic. Cl is more electronegative than S.

Question33

Which one of the following molecules contains no π bond? (2013 NEET)

Options:

A. SO_2

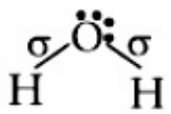
B. NO_2

C. CO_2

D. H_2O

Answer: D

Solution:



Question34

Which of the following does not give oxygen on heating? (NEET 2013)

Options:

A. $K_2Cr_2O_7$

B. $(NH_4)_2Cr_2O_7$

C. $KClO_3$

D. $Zn(ClO_3)_2$

Answer: B

Solution:

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$

$Zn(ClO_3)_2 \xrightarrow{\Delta} ZnCl_2 + 3O_2$

$KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2}O_2$

$2K_2Cr_2O_7 \xrightarrow{\Delta} K_2CrO_4 + Cr_2O_3 + \frac{3}{2}O_2$

Question35

Which of the following statements about the interstitial compounds is incorrect?
(2013 NEET)

Options:

A. They are much harder than the pure metal.

B. They have higher melting points than the pure metal.

C. They retain metallic conductivity.

D. They are chemically reactive.

Answer: D

Solution:

Interstitial compounds are generally chemically inert

Question36

In which of the following compounds, nitrogen exhibits highest oxidation state?
(NEET 2013)

Options:

A. N_2H_4

B. NH_3

C. N_3H

D. NH_2OH

Answer: C

Solution:

$N_2H_4 \Rightarrow 2x + 4(+1) = 0 \Rightarrow 2x + 4 = 0 \Rightarrow x = -2$
$NH_3 \Rightarrow x + 3(+1) = 0 \Rightarrow x = -3$
$N_3H \Rightarrow 3x + 1(+1) = 0 \Rightarrow 3x + 1 = 0 \text{ Rightarrow } \Rightarrow x = -\frac{1}{3}$
$NH_2OH \Rightarrow x + 2 + 1(-2) + 1 = 0 \Rightarrow x + 1 = 0 \Rightarrow x = -1$
Thus, highest oxidation state is $-\frac{1}{3}$.

Question37

Which of the following statements is not valid for oxoacids of phosphorus?
(2012)

Options:

A. Orthophosphoric acid is used in the manufacture of triple superphosphate

B. Hypophosphorous acid is a diprotic acid

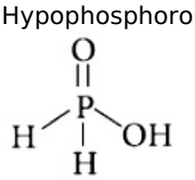
C. Ail oxoacids contain tetrahedral four coordinated phosphorus.

D. All oxoacids contain atleast one P = O unit and one P-OH group

Answer: B

Solution:

Hypophosphorous acid is a monoprotic acid.



Question38

Sulphur trioxide can be obtained by which of the following reaction?
(2012)

Options:

A. $CaSO_4 + C \xrightarrow{\Delta}$

B. $Fe_2(SO_4)_3 \xrightarrow{\Delta}$

C. $S + H_2SO_4 \xrightarrow{\Delta}$

D. $H_2SOS_4 + PCl_5 \xrightarrow{\Delta}$

Answer: B

Solution:

$$Fe_2(SO_4)_3 \xrightarrow{\Delta} Fe_2O_3 + 3SO_3$$

Question39

In which of the following arrangements the given sequence is not strictly according to the property indicated against it? (2012 Mains)

Options:

A. HF < HCl < HBR < HI : increasing acidic strength

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

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

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

Answer: B

Solution:

Acidic strength of hydrides increase with increase in molecular mass.
Thus order of acidic strength is
HF < HCl < HBr < HI
$H_2O < H_2S < H_2Se < H_2Te$
$NH_3 < PH_3 < AsH_3 < SbH_3$
And as acidic strength increases pK_a decreases.
Thus order of pK_a
$H_2O > H_2S > H_2Se > H_2Te$

Question40

Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively (2010)

Options:

A. +3, +5, +4

B. +5, +3, +4

C. +5, +4, +3

D. +3, +4, +5

Answer: D

Solution:

The oxidation state can be calculated as :
$H_4P_2O_5$
$+4 + 2x + 5(-2) = 0$
$2x - 6 = 0$
$x = +3$
$H_4P_2O_6$
$+4 + 2x + 6(-2) = 0$
$2x - 8 = 0$
$x = +4$
$H_4P_2O_7$
$+4 + 2x + 7(-2) = 0$
$2x - 10 = 0$
$2x = 10$
$x = +5$

Question41

The correct order of increasing bond angles in the following species is (2010)

Options:

A. $Cl_2O < ClO_2 < ClO_2^-$

B. $ClO_2 < Cl_2O < ClO_2^-$

C. $Cl_2O < ClO_2^- < ClO_2$

D. $ClO_2^- < Cl_2O < ClO_2$

Answer: D

Question42

How many bridging oxygen atoms are present in P_4O_{10} (2010 Mains)

Options:

A. 6

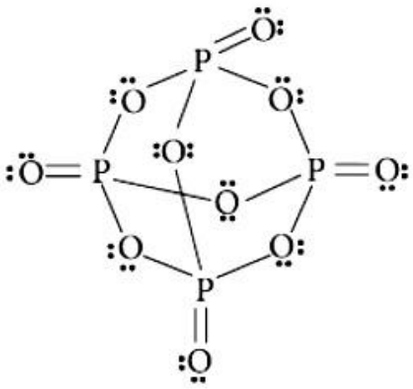
B. 4

C. 2

D. 3

Answer: A

Solution:



Question43

Among the following which is the strongest oxidising agent? (2009)

Options:

A. Br_2

B. I_2

C. Cl_2

D. F_2

Answer: D

Solution:

Solution:
Standard reduction potentials of halogens are positive and decrease from fluorine to iodine. So,F_2 is the strongest oxidising agent

---

Question44

The angular shape of ozone molecule (O_3) consists of (2008)

Options:

A. 1 σ and 1 π bond

B. 2 σ and 1 π bond

C. 1 σ and 2 π bonσds

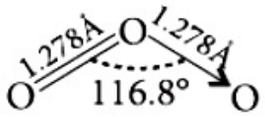
D. 2 σ and 2 π bonds

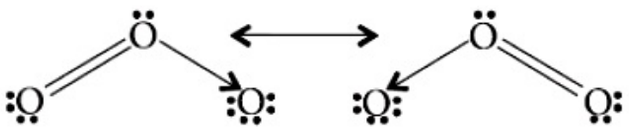
Answer: B

Solution:

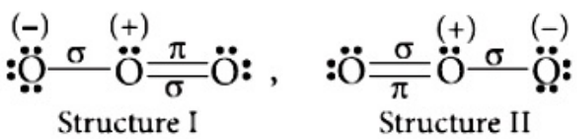
The angular shape of ozone molecule (O_3)

$_3$)





.O_3 molecules can be represented by the following two Lewis structures.



Question45

The electronegativity difference between N and F is greater than that between N and H yet the dipole moment of NH_3 (1.5D) is larger than that of NF_3(0.2D). This is because (2006)

Options:

A. in NH_3 the atomic dipole and bond dipole are in the opposite directions whereas in NF_3 these are in the same direction

B. inNH_3 as well as in NF_3 the atomic dipole and bond dipole are in the same direction

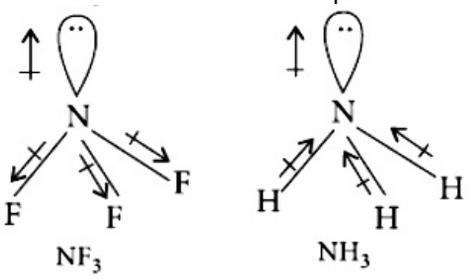
C. in NH_3 the atomic dipole and bond dipole are in the same direction whereas in NF_3 these are in opposite directions

D. inNH_3 as well as in NF_3 the atomic dipole and bond dipole are in opposite directions.

Answer: C

Solution:

The dipole moment of NF_3 0.24 D and of NH_3 is 1.48 D. The difference is due to fact that while the dipole moment due to N - F bonds in NF_3 are in opposite direction to the direction of the dipole moment of the lone pair on N atom which partly cancel out, the dipole moment of N - H bonds in NH_3 are in the same direction of the dipole moment of the lone pair on N atom which adds up as shown below.



Question46

Which one of the following orders is not in accordance with the property stated against it?
(2006)

Options:

A. $F_2 > Cl_2 > Br_2 > I_2$: Bond dissociation energy

B. $F_2 > Cl_2 > Br_2 > I_2$: Oxidising power

C. $HI > HBr > HCl > HF$: Acidic property in water

D. $F_2 > Cl_2 > Br_2 > I_2$: Electronegativity

Answer: A

Solution:

X - X bond	F - F	Cl - Cl	Br-Br	I-I
Bond dissociation energy(kcl/mol)	38	57	45.5	35.6

The lower value of bond dissociation energy of fluorine is due to the high inter-electronic repulsions between non-bonding electrons in the 2p-orbitals of fluorine. As a result F - F bond is weaker in comparison to Cl Cl and Br - Br bonds.

Question47

In which of the following molecules are all the bonds are not equal?
(2006)

Options:

A. NF_3

B. ClF_3

C. BF_3

D. AlF_3

Answer: B

Solution:

Solution:
The $Cl-F(Cl-F_b)$ bond length is equal to 1.60Å while each of the two axial $Cl-F(Cl-F_a)$ bond length is equal to 1.70 Å.

Question48

What is the correct relationship between the pH of isomolar solutions of sodium oxide, Na_2O (pH_1), sodium sulphide, Na_2S (pH_2), sodium selenide, Na_2Se (pH_3) andsodium telluride Na_2Te (pH_4)? (2005)

Options:

A. $pH_1 > pH_2 > pH_3 > pH_4$

B. $pH_1 > pH_2 \approx pH_3 > pH_4$

C. $pH_1 < pH_2 < pH_3 < pH_4$

D. $pH_1 < pH_2 < pH_3 \approx pH_4$

Answer: A

Solution:

Solution:

Na_2O
Na_2S
Na_2Se
Na_2Te

Basic character decreases down the group

$pH \propto$ basic character

Hence, $pH_1 > pH_2 > pH_3 > pH_4$

Question49

Which one of the following oxides is expected to exhibit paramagnetic behaviour?
(2005)

Options:

A. CO_2

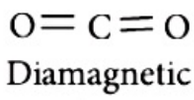
B. SiO_2

C. SO_2

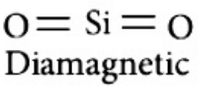
D. $Cl\,O_2$

Answer: D

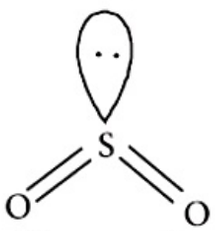
Solution:



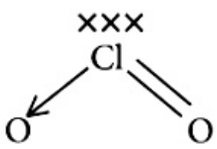
Diamagnetic



Diamagnetic



Diamagnetic



Paramagnetic

Question50

Which of the following would have a permanent dipole moment?
(2005)

Options:

A. SiF_4

B. SF_4

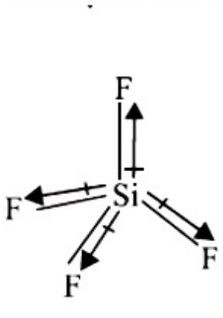
C. XeF_4

D. BF_3

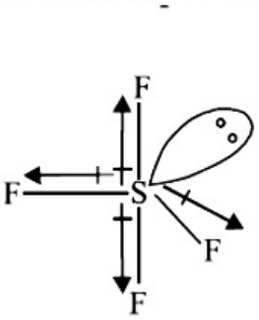
Answer: B

Solution:

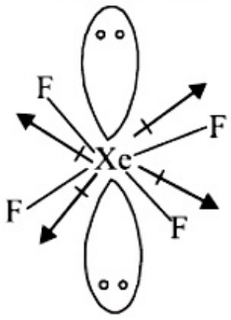
For dipole moment, we have to know the hybridisation and shape.



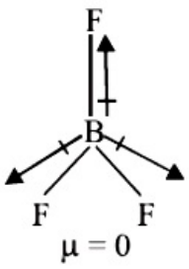
$\mu = 0$



$\mu \neq 0$



$\mu = 0$



$\mu = 0$

Question51

Which of the following statements is true? (2002)

Options:

A. Silicon exhibits 4 coordination number in its compound.

B. Bond energy of F_2 is less than Cl_2.

C. $Mn(III)$ oxidation state is more stable than $Mn(II)$ in aqueous state.

D. Elements of 15^{th} gp shows only +3 and +5 oxidation states.

Answer: B

Solution:

Fluorine is more reactive than chlorine. So bond energy of chlorine is greater than fluorine.
Silicon exhibits coordination number 6.
In aqueous state Mn(II) is more stable.
$Mn \rightleftharpoons Mn^{2+} + 2e^-$
The common oxidation states of 15^{th} group elements are -3,+3 and +5 .

Question52

Which compound has planar structure? (2000)

Options:

A. XeF_4

B. $XeOF_2$

C. XeO_2F_2

D. XeO_4

Answer: A

Solution:

In XeF_4 the Xe' atom is sp^3d^2 hybridised, which contains two lone pair orbitals and four bond pair orbitals. Therefore the shape of XeF_4 molecule is square planar, with one lone pair orbital over and other below the plane.

Question53

Which of the following oxides is most acidic? (1999)

Options:

A. As_2O_5

B. P_2O_5

C. N_2O_5

D. Sb_2O_5

Answer: C

Solution:

Solution:
As among N , P, As and Sb, the former has highest electronegativity (EN) so its oxide is most acidic.
As the electronegativity value of element increases, the acidic character of the oxide also increases.

The oxide with the highest positive oxidation state on the element other than O should be most acidic. Oxidation state of V in V_2O_5 and N in N_2O_5 are same. But the electronegativity of N is higher, making N_2O_5 the most acidic oxide.

Question54

Which of the following phosphorus is the most reactive? (1999)

Options:

A. Scarlet phosphorus

B. White phosphorus

C. Red phosphorus

D. Violet phosphorus

Answer: B

Solution:

White phosphorus has low ignition temperature so it is most reactive among all the allotropes.

Question55

Which of the following is used in the preparation of chlorine? (1999)

Options:

A. Both MnO_2 and $KMnO_4$

B. Only $KMnO_4$

C. Only MnO_2

D. Either MnO_2 or $KMnO_4$

Answer: A

Solution:

$$MnO_2 + 4\ HCl \rightarrow MnCl_2 + 2H_2O + Cl_2\uparrow$$
$$2KMnO_4 + 16\,HCl \rightarrow 2\,KCl + 2MnCl_2 + 8H_2O + 5Cl_2\uparrow$$

Question56

Repeated use of which one of the following fertilizers would increase the acidity of the soil? (1998)

Options:

A. Ammonium sulphate

B. Superphosphate of lime

C. Urea

D. Potassium nitrate

Answer: A

Solution:

Ammonium sulphate is a salt of strong acid (H_2SO_4) and weak base (NH_4OH) Therefore, repeated use of ammonium sulphate would increase the concentration of sulphuric acid, while ammonia from NH_4OH is used up by the plant. Hence, the acidity of soil will increase.

Question57

Which of the following has the highest dipole moment? (1997)

Options:

A. SbH_3

B. AsH_3

C. NH_3

D. PH_3

Answer: C

Solution:

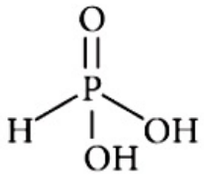
Due to greater electronegativity of nitrogen, dipole moment for NH_3 is greater.

Question58

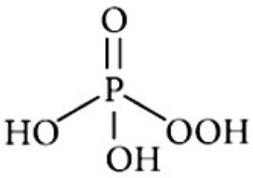
The structural formula of hypophosphorous acid is (1997)

Options:

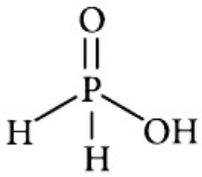
A.



B.



C.



D. None of these.

Answer: C

Solution:

The formula of hypophosphorous acid is H_3PO_2 as shown in (c). It is a monobasic acid.

Question59

Which of the following bonds has the highest energy? (1996)

Options:

A. S-S

B. O-O

C. Se-Se

D. Te-Te

Answer: A

Solution:

B . E.	O − O	S − S	Se − Se	Te − Te
(kJ mol^{-1}):	142	226	172	126

Question60

The basic character of hydrides of the V group elements decreases in the order
(1996)

Options:

A. $NH_3 > PH_3 > AsH_3 > SbH_3$

B. $SbH_3 > AsH_3 > PH_3 > NH_3$

C. $SbH_3 > PH_3 > AsH_3 > NH_3$

D. $NH_3 > SbH_3 > PH_3 > AsH_3$

Answer: A

Solution:

All the hydrides of group V elements have one lone pair of electrons on their central atom. Therefore, they can act as Lewis bases. The basic character of these hydrides decreases down the group.

Question61

Among the following oxides, the lowest acidic is
(1996)

Options:

A. As_4O_6

B. $As_4 O_{10}$

C. $P_4 O_6$

D. $P_4 O_{10}$

Answer: A

Solution:

The acidic character of the oxides decreases with the decrease in the oxidation state and also decreases down the group.

Question62

Which of the following has the greatest electron affinity? (1996)

Options:

A. I

B. Br

C. F

D. Cl

Answer: D

Solution:

Solution:
In general, the electron affinity decreases from top to bottom in a group. But in group 17, fluorine has lower electron affinity as compared to chlorine due to very small size of fluorine atom.

Question63

Which of the following represents calcium chlorite? (1996)

Options:

A. $Ca(ClO_3)_2$

B. $Ca(ClO_2)_2$

C. $CaClO_2$

D. $Ca\ (\ ClO_4\ )_2$

Answer: B

Solution:

Solution:
since the valency of calcium is 2 and a chlorite ion is ClO_2^-, the calcium chlorite is $Ca\ (\ ClO_2\ )_2$.

Question64

Reaction of sodium thiosulphate with iodine gives (1996)

Options:

A. tetrathionate ion

B. sulphide ion

C. sulphate ion

D. sulphite ion.

Answer: A

Solution:

$$2\ Na_2\ S_2\ O_3 + \ I_2 \rightarrow \underset{\text{(Sodium tetrathionate)}}{Na_2\ S_4\ O_6} + 2\ \ NaI$$

Question65

About 20 km above the earth, there is an ozone layer. Which one of the following statements about ozone and ozone layer is true? (1995)

Options:

A. It is beneficial to us as it stops U.V. radiation.

B. Conversion of O_3 to O_2 is an endothermic reaction.

C. Ozone is a triatomic linear molecule.

D. It is harmful as it stops useful radiation.

Answer: A

Solution:

Solution:
Ozone layer is very beneficial to us, because it stops harmful ultraviolet radiations to reach the earth.

Question66

The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^3$. What is the atomic number of the element, which is just below the above

element in the periodic table?
(1995)

Options:

A. 36

B. 49

C. 33

D. 34

Answer: C

Solution:

Atomic number of the given element is 15 and it belongs to 5^{th} group. Therefore atomic number of the element below the above element $= 15 + 18 = 33$.

Question67

Which of the following oxides of nitrogen is paramagnetic?
(1994)

Options:

A. NO_2

B. $N_2 O_3$

C. $N_2 O$

D. $N_2 O_5$

Answer: A

Solution:

NO_2 is paramagnetic due to the presence of unpaired electrons.

Question68

Which of the following displaces Br_2 from an aqueous solution containing bromide ions?

(1994)

Options:

A. I_2

B. I_3^-

C. Cl_2

D. Cl^-

Answer: C

Solution:

since chlorine is more electronegative than bromine, therefore it will displace bromine from an aqueous solution containing bromide ions.
$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

Question69

Which of the following fluorides does not exist?
(1993)

Options:

A. NF_5

B. PF_5

C. As F_5

D. SbF_5

Answer: A

Solution:

Solution:
Nitrogen cannot form pentahalides because it cannot expand its octet due to non-availability of d -orbitals.

Question70

Which of the following species has four lone pairs of electrons?
(1993)

Options:

A. I

B. O^-

C. Cl^-

D. He

Answer: C

Solution:

Outer electronic configuration of Cl $= 3s^2 3p_x^2 3p_y^2 3p_z^1$
Outer electronic configuration of Cl^- $= 3s^2 3p_x^2 3p_y^2 3p_z^2$, i.e., 4 lone pair of electrons

---

Question71

Which of the following sets has strongest tendency to form anions? (1993)

Options:

A. Ga, Ni, Tl

B. Na, Mg, Al

C. N, O, F

D. V, Cr, Mn

Answer: C

Solution:

Solution:
N, O and F are highly electronegative non-metals and will have the strongest tendency to form anions by gaining electrons from metal atoms.

Question72

A solution of potassium bromide is treated with each of the following. Which one would liberate bromine? (1993)

Options:

A. Hydrogen iodide

B. Sulphur dioxide

C. Chlorine

D. Iodine

Answer: C

Solution:

A stronger oxidising agent (Cl_2) displaces a weaker oxidising agent (Br_2) from its salt solution.
$2\,KBr + Cl_2 \rightarrow 2\,KCl + Br_2$

Question73

Which of the following elements is extracted commercially by the electrolysis of an aqueous solution of its compound? (1993)

Options:

A. Cl

B. Br

C. Al

D. Na

Answer: A

Solution:

Solution:
Chlorine is obtained by the electrolysis of brine (concentrated NaCl solution). Chlorine is liberated at anode.

Question74

Number of electrons shared in the formation of nitrogen molecule is (1992)

Options:

A. 6

B. 10

C. 2

D. 8

Answer: A

Solution:

Solution:

Nitrogen molecule is diatomic containing a triple bond between two N atoms, $\ddot{N} \equiv \ddot{N}$ therefore, nitrogen molecule is formed by sharing six electrons.

Question75

Sugarcane on reaction with nitric acid gives (1992)

Options:

A. CO_2 and SO_2

B. $(COOH)_2$

C. 2 HCOOH (two moles)

D. no reaction.

Answer: B

Solution:

$$\underset{\text{Cane sugar}}{C_{12}H_{22}O_{11}} + \underset{\text{From } HNO_3}{18[O]} \rightarrow \underset{\text{Oxalic acid}}{6(COOH)_2} + 5H_2O$$

Question76

Nitrogen is relatively inactive element because (1992)

Options:

A. its atom has a stable electronic configuration

B. it has low atomic radius

C. its electronegativity is fairly high

D. dissociation energy of its molecule is fairly high.

Answer: D

Solution:

N_2 molecule contains triple bond between N atoms having very high dissociation energy ($946\,kJ\,mol^{-1}$) due to which it is relatively inactive.

Question77

H_3PO_2 is the molecular formula of an acid of phosphorus. Its name and basicity respectively are (1992)

Options:

A. phosphorous acid and two

B. hypophosphorous acid and two

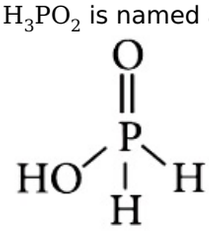
C. hypophosphorous acid and one

D. hypophosphoric acid and two.

Answer: C

Solution:

H_3PO_2 is named as hypophosphorous acid. As it contains only one $P-OH$ group, its basicity is one.



Question78

Which of the following bonds will be most polar? (1992)

Options:

A. N-Cl

B. O-F

C. N-F

D. N-N

Answer: C

Solution:

Polarity of the bond depends upon the electronegativity difference of the two atoms forming the bond. Greater the electronegativity difference, more is the polarity of the bond.

$N-Cl$	$O-F$	$N-F$	$N-N$
$3.04-3.16$	$3.5-4.0$	$3.04-4.0$	$3.04-3.04$

Question79

Elements of which of the following groups will form anions most readily?
(1992)

Options:

A. Oxygen family

B. Nitrogen family

C. Halogens

D. Alkali metals

Answer: C

Solution:

Solution:
As halogens have seven electrons (ns^2np^5) in the valence shell, they have a strong tendency to acquire the nearest inert gas configuration by gaining an electron from the metallic atom and form halide ions easily.

Question80

Strongest hydrogen bonding is shown by
(1992)

Options:

A. water

B. ammonia

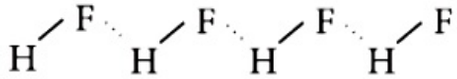
C. hydrogen fluoride

D. hydrogen sulphide.

Answer: C

Solution:

Solution:
Fluorine because of its smaller size and highest electronegativity shows strongest hydrogen bonding.



Question81

When chlorine is passed over dry slaked lime at room temperature, the main reaction product is
(1992)

Options:

A. $Ca(ClO_2)_2$

B. $CaCl_2$

C. $CaOCl_2$

D. $Ca(OCl)_2$

Answer: C

Solution:

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Question82

In the manufacture of bromine from sea water, the mother liquor containing bromides is treated with
(1992)

Options:

A. carbon dioxide

B. chlorine

C. iodine

D. sulphur dioxide.

Answer: B

Solution:

Bromide in the mother liquor (containing $MgBr_2$) is oxidised to Br_2 by passing Cl_2 which is a stronger oxidising agent.
$2Br^- + Cl_2 \rightarrow Br_2 + 2Cl^-$

Question83

Which would quickly absorb oxygen? (1991)

Options:

A. Alkaline solution of pyrogallol

B. Conc. H_2SO_4

C. lime water

D. alkaline solution of $CuSO_4$

Answer: A

Solution:

Alkaline solution of pyrogallol absorbs oxygen quickly.

Question84

Oleum is (1991)

Options:

A. castor oil

B. oil of vitriol

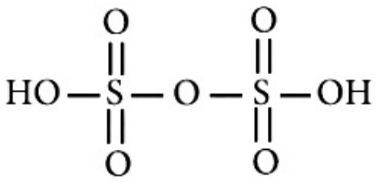
C. fuming H_2SO_4

D. none of these.

Answer: C

Solution:

Pyrosulphuric acid or oleum (+6) is $H_2S_2O_7$ which is obtained by dissolving SO_3 and is called fuming sulphuric acid.



Question85

Aqueous solution of ammonia consists of (1991)

Options:

A. H^+

B. OH^-

C. NH_4^+

D. NH_4^+ and OH^-.

Answer: D

Solution:

Aqueous solution of ammonia contains NH_4^+ and OH^- ions.
$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

Question86

P_2O_5 is heated with water to give (1991)

Options:

A. hypophosphorous acid

B. phosphorous acid

C. hypophosphoric acid

D. orthophosphoric acid.

Answer: D

Solution:

$P_2O_5 + 3H_2O \xrightarrow{\Delta} 2H_3PO_4$

Question87

Basicity of orthophosphoric acid is (1991)

Options:

A. 2

B. 3

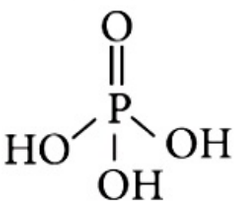
C. 4

D. 5

Answer: B

Solution:

Orthophosphoric acid, H_3PO_4 contains three $P-OH$ groups and is therefore, tribasic.



Question88

PCl_3 reacts with water to form (1991)

Options:

A. PH_3

B. H_3PO_3, HCl

C. $POCl_3$

D. H_3PO_4

Answer: B

Solution:

$PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3\,HCl$

Question89

PH_4I + NaOH forms
(1991)

Options:

A. PH_3

B. NH_3

C. P_4O_6

D. P_4O_{10}

Answer: A

Solution:

$PH_4I + NaOH \rightarrow NaI + PH_3 + H_2O$

Question90

Pure nitrogen is prepared in the laboratory by heating a mixture of (1991)

Options:

A. $NH_4OH + NaCl$

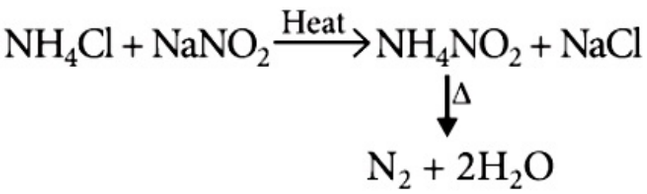
B. $NH_4NO_3 + NaCl$

C. $NH_4Cl + NaOH$

D. $NH_4Cl + NaNO_2$

Answer: D

Solution:



Question91

The bleaching action of chlorine is due to (1991)

Options:

A. reduction

B. hydrogenation

C. chlorination

D. oxidation

Answer: D

Solution:

Bleaching action of chlorine is due to oxidation in presence of moisture. It is permanent.
$H_2O + Cl_2 \rightarrow 2\,HCl + [O]$
Colouring matter +[O]→ colourless matter

Question92

Which of the following statement is not correct for nitrogen? (1990)

Options:

A. Its electronegativity is very high.

B. d -orbitals are available for bonding.

C. It is a typical non-metal.

D. Its molecular size is small.

Answer: B

Solution:

In case of nitrogen, d -orbitals are not available for bonding.
N : $1s^2 2s^2 2p^3$

Question93

Which of the following compound does not exist? (1989)

Options:

A. NCl_5

B. AsF_5

C. $SbCl_5$

D. PF_5

Answer: A

Solution:

Solution:
All the elements of group 15 form trihalides and pentahalides of the type MX_3 and MX_5 except nitrogen which forms only trihalides. Moreover, nitrogen does not form pentahalides due to the absence of d -orbitals in its valence shell.

Question94

Each of the following is true for white and red phosphorus except that they (1989)

Options:

A. are both soluble in CS_2

B. can be oxidised by heating in air

C. consist of the same kind of atoms

D. can be converted into one another.

Answer: A

Solution:

Red phosphorus is insoluble in CS_2 and only white P is soluble in CS_2.

Question95

When orthophosphoric acid is heated to 600°C, the product formed is (1989)

Options:

A. PH_3

B. P_2O_5

C. H_3PO_3

D. HPO_3

Answer: D

Solution:

Solution:
On heating, it gives pyrophosphoric acid at 525K and metaphosphoric acid at 875K.

Question96

Which one has the lowest boiling point? (1989)

Options:

A. NH_3

B. PH_3

C. AsH_3

D. SbH_3

Answer: B

Solution:

Solution:
Boiling point of hydrides increases with increase in atomic number but ammonia has exceptionally high boiling point due to hydrogen bonding. Thus the correct order of boiling point is,
$BiH_3 > SbH_3 > NH_3 > AsH_3 > PH_3$

Question97

Oxygen will directly react with each of the following elements except (1989)

Options:

A. P

B. Cl

C. Na

D. S

Answer: B

Solution:

Solution:
Chlorine does not react directly with oxygen.

Question98

The gases respectively absorbed by alkaline pyrogallol and oil of cinnamon are (1989)

Options:

A. O_3, CH_4

B. O_2, O_3

C. SO_2, CH_4

D. N_2O, O_3

Answer: B

Solution:

Solution:
Alkaline pyrogallol absorbs O_2 and oil of cinnamon absorbs O_3.

Question99

It is possible to obtain oxygen from air by fractional distillation because (1989)

Options:

A. oxygen is in a different group of the periodic table from nitrogen

B. oxygen is more reactive than nitrogen

C. oxygen has higher b.pt. than nitrogen

D. oxygen has a lower density than nitrogen.

Answer: C

Solution:

Solution:
Air is liquefied by making use of the Joule - Thomson effect (cooling by expansion of the gas). Water vapour and CO_2 are removed by solidification. The remaining constituents of liquid air i . e., liquid oxygen and liquid nitrogen are separated by means of fractional distillation (b.pt. of $O_2 = -183°C$: b.pt. of $N_2 = -195.8°C$)

Question100

Bleaching powder reacts with a few drops of conc. HCl to give (1989)

Options:

A. chlorine

B. hypochlorous acid

C. calcium oxide

D. oxygen.

Answer: A

Solution:

Solution:
$CaOCl_2 + 2\,HCl \rightarrow CaCl_2 + H_2O + Cl_2$

Question101

Which of the following is a nitric acid anhydride? (1988)

Options:

A. NO

B. NO_2

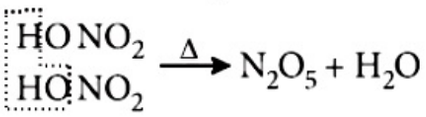
C. N_2O_5

D. N_2O_3

Answer: C

Solution:

When 2 -molecules of nitric acid undergoes heating, loose a water molecule to form an anhydride.



Thus, N_2O_5 is nitric acid anhydride.
