

17

p-Block Elements

TOPIC 1

Group 13 Elements

- 01** Which one of the following elements is unable to form MF_6^{3-} ion? [NEET 2018]

(a) B (b) Al
(c) Ga (d) In

Ans. (a)

Boron belongs to 2nd period of the periodic table with electronic configuration $1s^2, 2s^2 2p^1$. It does not have vacant d -orbitals, thus cannot increase its covalency above four.

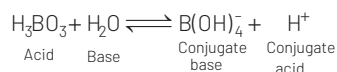
Therefore, boron (B) cannot form MF_6^{3-} ion. In contrast, aluminium (Al), gallium (Ga), indium (In) have the vacant $3d$ -orbitals, thus can increase their covalence above four and form MF_6^{3-} ion.

- 02** Boric acid is an acid because its molecule [NEET 2016, Phase II]

(a) contains replaceable H^+ ion
(b) gives up a proton
(c) accepts OH^- from water releasing proton
(d) combines with proton from water molecule

Ans. (c)

Boric acid can be considered as an acid because its molecule accepts OH^- from water, releasing proton.



Remember In the given options to the question, (a), (b) and (c) are correct as all of these sentences have more or less similar meaning but here (c) option is the most appropriate one as it gives complete explanation of the fact that how boric acid can be combined with an acid.

- 03** AlF_3 is soluble in HF only in presence of KF. It is due to the formation of [NEET 2016, Phase II]

(a) $K_3[AlF_3H_3]$ (b) $K_3[AlF_6]$
(c) AlH_3 (d) $K[AlF_3H]$

Ans. (b)

Key Idea Al^{3+} shows maximum coordination number 6, thus it will form AlF_6^{3-} .

AlF_3 forms $K_3[AlF_6]$ when dissolved in HF in the presence of KF as shown below:



- 04** The stability of +1 oxidation state among Al, Ga, In and Tl increases in the sequence [CBSE AIPMT 2015]

(a) $Ga < In < Al < Tl$ (b) $Al < Ga < In < Tl$
(c) $Tl < In < Ga < Al$ (d) $In < Tl < Ga < Al$

Ans. (b)

$Al < Ga < In < Tl$

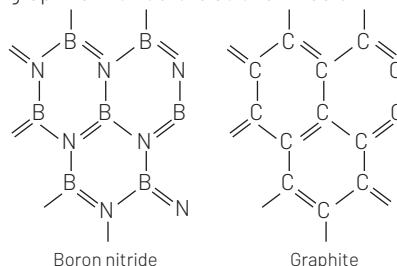
This is due to inert pair effect or tendency of ns^2 electrons do not participate in bond formation. This tendency decreases on moving down the group.

- 05** Which of the following structure is similar to graphite? [NEET 2013]

(a) BN (b) B (c) B_4C (d) B_2H_6

Ans. (a)

Boron nitride $(BN)_x$ resembles with graphite in structure as shown below



- 06** Which one of the following molecular hydrides acts as a Lewis acid? [CBSE AIPMT 2010]

(a) NH_3 (b) H_2O
(c) B_2H_6 (d) CH_4

Ans. (c)

Key Idea Electron deficient molecules behave as Lewis acid.

Among the given molecules, only diborane is electron deficient, i.e. does not have complete octet. Thus, it acts as a Lewis acid.

NH_3 and H_2O being electron rich molecules behave as Lewis base.

- 07** The tendency of BF_3 , BCl_3 and BBr_3 behave as Lewis acid decreases in the sequence [CBSE AIPMT 2009]

(a) $BCl_3 > BF_3 > BBr_3$
(b) $BBr_3 > BCl_3 > BF_3$
(c) $BBr_3 > BF_3 > BCl_3$
(d) $BF_3 > BCl_3 > BBr_3$

Ans. (b)

As the size of halogen atom increases, the acidic strength of boron halides increases. Thus, BF_3 is the weakest Lewis acid. This is because of the $p\pi - p\pi$ back bonding between the fully filled unutilised $2p$ -orbitals of F and vacant $2p$ -orbitals of boron which makes BF_3 less electron deficient. Such back donation is not possible in case of BCl_3 or BBr_3 due to larger energy difference between their orbitals. Thus, these are more electron deficient. Since on moving down the group the energy difference increases, the Lewis acid character also increases. Thus, the tendency to behave as Lewis acid follows the order

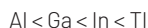


08 The stability of +1 oxidation state increases in the sequence
[CBSE AIPMT 2009]

- (a) $\text{Al} < \text{Ga} < \text{In} < \text{Tl}$ (b) $\text{Tl} < \text{In} < \text{Ga} < \text{Al}$
(c) $\text{In} < \text{Tl} < \text{Ga} < \text{Al}$ (d) $\text{Ga} < \text{In} < \text{Al} < \text{Tl}$

Ans. (a)

The given elements belong to third group. These elements mainly exhibit +3 and +1 oxidation states. As we know, the stability of lower oxidation state, increases on moving down a group due to inert pair effect. Thus, the sequence of stability of +1 state is



09 Al_2O_3 can be converted into anhydrous AlCl_3 by heating
[CBSE AIPMT 2006]

- (a) Al_2O_3 with HCl gas
(b) Al_2O_3 with NaCl in solid state
(c) a mixture of Al_2O_3 and carbon in dry Cl_2 gas
(d) Al_2O_3 with Cl_2 gas

Ans. (c)

Al_2O_3 may be converted into anhyd. AlCl_3 by heating a mixture of Al_2O_3 and carbon in dry chlorine.



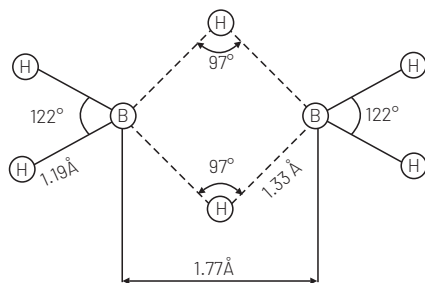
NOTE Anhydrous AlCl_3 exists in the form of dimer as Al_2Cl_6

10 Which of the following is the electron deficient molecule?
[CBSE AIPMT 2005]

- (a) B_2H_6 (b) C_2H_6
(c) PH_3 (d) SiH_4

Ans. (a)

B_2H_6 is electron deficient molecule because boron atom has three half-filled orbitals in excited state. The structure of B_2H_6 is represented as follows:



In it two electrons of a $\text{B}-\text{H}$ bond are involved in formation of three centre bond, these bonds are represented as dotted lines.

11 Which one of the following statements about the zeolites is false?
[CBSE AIPMT 2004]

- (a) They are used as cation exchangers
(b) They have open structure which enables them to take up small molecules
(c) Zeolites are aluminosilicates having three dimensional network
(d) Some of the SiO_4^{4-} units are replaced by AlO_4^{5-} and AlO_6^{9-} ions in zeolites

Ans. (d)

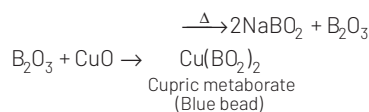
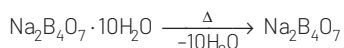
Zeolites are aluminosilicates having three dimensional open structure in which four or six membered rings predominates. Thus, due to open chain structure, they have cavities and can take up water and other small molecules.

12 In borax bead test which compound is formed?
[CBSE AIPMT 2002]

- (a) *Ortho* borate (b) *Meta* borate
(c) Double oxide (d) Tetra borate

Ans. (b)

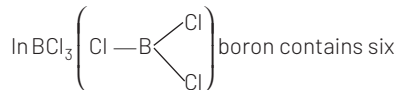
In borax bead test the coloured *meta* borates are formed by transition metal salts.



13 Among the following the electron deficient compound is
[CBSE AIPMT 2000]

- (a) BCl_3 (b) CCl_4 (c) PCl_5 (d) BeCl_2

Ans. (a)



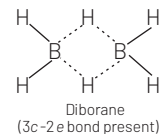
electrons in its valence shell so, it is capable to accommodate one pair of electrons. Hence, it acts as Lewis acid or electron deficient (incomplete octate) compound. As we know that Lewis acids are the substances having a tendency to accept a pair of electron.

14 Which of the following compound has a 3-centre bond?
[CBSE AIPMT 1996]

- (a) Diborane (b) CO_2
(c) Boron trifluoride
(d) Ammonia

Ans. (a)

In diborane 3 centred 2 electron bond is present.

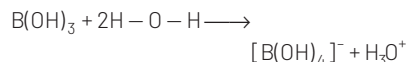


15 Which of the following statements about H_3BO_3 is not correct?
[CBSE AIPMT 1994]

- (a) It is a strong tribasic acid
(b) It is prepared by acidifying an aqueous solution of borax
(c) It has a layer structure in which planar BO_3 units are joined by hydrogen bonds
(d) It does not act as proton donor but acts as a Lewis acid by accepting hydroxyl ion

Ans. (a)

Boric acid (H_3BO_3) is a weak monobasic acid with $K_a = 1.0 \times 10^{-9}$. It may be noted that boric acid does not act as a protonic acid (i.e. proton donor) but behaves as a Lewis acid by accepting a pair of electrons from OH^- ion.



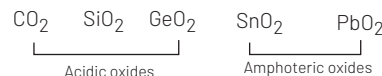
TOPIC 2 Group 14 Elements

16 Which of the following oxide is amphoteric in nature?
[NEET (Oct.) 2020]

- (a) SnO_2 (b) SiO_2
(c) GeO_2 (d) CO_2

Ans. (a)

Nature of dioxides (MO_2) of group 14 elements can be represented as.



Hence, option (a) is correct.

17 Identify the correct statements from the following:

- $\text{CO}_2(g)$ is used as refrigerant for ice-cream and frozen food.
- The structure of C_{60} contains twelve six carbon rings and twenty five carbon rings.

3. ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
4. CO is colourless and odourless gas. [NEET (Sep.) 2020]

- (a) (1) and (3) only
(b) (2) and (3) only
(c) (3) and (4) only
(d) (1), (2) and (3) only

Ans. (c)

3 and 4 are correct statements, whereas 1 and 2 are incorrect.

1. Dry ice or $\text{CO}_2(\text{s})$ [not $\text{CO}_2(\text{g})$] is used as refrigerant for ice-cream and frozen food.
2. C_{60} contains 20 hexagones (not 12) and 12 pentagones (not 20).
3. ZSM-5, a type of zeolite, is used to convert alcohols directly into gasoline. It is true.
4. CO is a colourless and odourless gas. It is true.

- 18** Which of the following is incorrect statement? [NEET (National) 2019]

- (a) SiCl_4 is easily hydrolysed
(b) GeX_4 ($\text{X} = \text{F}, \text{Cl}, \text{Br}, \text{I}$) is more stable than GeX_2
(c) SnF_4 is ionic in nature
(d) PbF_4 is covalent in nature

Ans. (d)

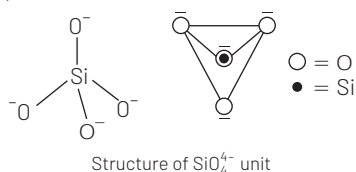
All the tetrahalides of group 14 elements are covalent in nature and sp^3 -hybridised with tetrahedral geometry. Exceptions are SnF_4 and PbF_4 which are ionic in nature. Thus, statement (d) is incorrect while the remaining statements are correct.

- 19** The basic structural unit of silicates is [NEET 2013]

- (a) SiO^- (b) SiO_4^{4-}
(c) SiO_3^{2-} (d) SiO_4^{2-}

Ans. (b)

The basic building unit of all silicates is the tetrahedral SiO_4^{4-} . It is represented as



- 20** Which of these is not a monomer for a high molecular mass silicon polymer? [NEET 2013]

- (a) MeSiCl_3 (b) Me_2SiCl_2
(c) Me_3SiCl (d) PhSiCl_3

Ans. (c)

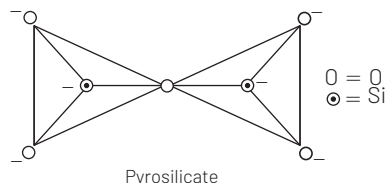
Me_3SiCl is not a monomer for a high molecular mass silicon polymer because it generates Me_3SiOH when subjected to hydrolysis which contains only one reacting site. Hence, the polymerisation reaction stops just after first step.

- 21** Name the type of the structure of silicate in which one oxygen atom of $[\text{SiO}_4]^{4-}$ is shared? [CBSE AIPMT 2011]

- (a) Sheet silicate
(b) Pyrosilicate
(c) Three dimensional silicate
(d) Linear chain silicate

Ans. (b)

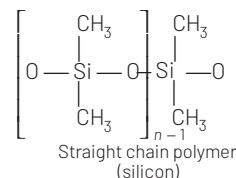
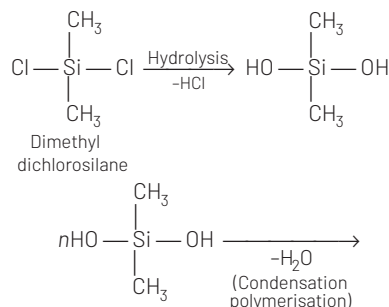
In pyrosilicate, only one oxygen atom is shared.



- 22** The straight chain polymer is formed by [CBSE AIPMT 2009]

- (a) hydrolysis of $(\text{CH}_3)_3\text{SiCl}$ followed by condensation polymerisation
(b) hydrolysis of CH_3SiCl_3 followed by condensation polymerisation
(c) hydrolysis of $(\text{CH}_3)_4\text{Si}$ by addition polymerisation
(d) hydrolysis of $(\text{CH}_3)_2\text{SiCl}_2$ followed by condensation polymerisation

Ans. (d)



Straight chain silanes are silicon oils. These are more stable at high temperature than mineral oils and have less tendency to thicken at low temperature.

- 23** Which one of the following anions is present in the chain structure silicates? [CBSE AIPMT 2007]

- (a) $\text{Si}_2\text{O}_7^{6-}$ (b) $(\text{Si}_2\text{O}_5^{2-})_n$
(c) $(\text{SiO}_3^{2-})_n$ (d) SiO_4^{4-}

Ans. (c)

$[\text{SiO}_3^{2-}]_n$ and $[\text{Si}_4\text{O}_{11}]^{6-}$ have chain structure of silicates.

- 24** Which of the following oxidation states are the most characteristics for lead and tin respectively? [CBSE AIPMT 2007]

- (a) +4, +2 (b) +2, +4
(c) +4, +4 (d) +2, +2

Ans. (b)

The tendency to form +2 ionic state increase on moving down the group due to inert pair effect.

Most characteristic oxidation state for lead and tin are +2, +4 respectively.

- 25** Percentage of lead in lead pencil is [CBSE AIPMT 1999]

- (a) zero (b) 20 (c) 80 (d) 70

Ans. (a)

In lead pencil graphite and clay is present, so the percentage of lead is zero.

- 26** Which of the following does not show electrical conduction? [CBSE AIPMT 1999]

- (a) Potassium (b) Graphite
(c) Diamond (d) Sodium

Ans. (c)

Diamond does not show electrical conductivity due to the absence of free electrons. Sodium and potassium are metallic conductors while graphite is a non-metallic conductor.

- 27** A one litre flask is full of brown bromine vapours. The intensity of brown colour of vapours will not decrease appreciably on adding to the flask some [CBSE AIPMT 1998]

(a) pieces of marble
(b) animal charcoal powder
(c) carbon tetrachloride
(d) carbon disulphide

Ans. (a)

Bromine is soluble in CCl_4 and CS_2 . Animal charcoal also adsorbs on bromine water. But marble has no action with Br_2 . So, after adding marble piece to the flask, there will be no change in the intensity of brown colour.

- 28** The structure and hybridisation of $\text{Si}(\text{CH}_3)_4$ is [CBSE AIPMT 1996]

(a) octahedral, sp^3d
(b) tetrahedral, sp^3
(c) bent, sp
(d) trigonal, sp^2

Ans. (b)

In tetramethyl silicane, i.e. $\text{Si}(\text{CH}_3)_4$, Si is sp^3 hybridised. Hence it has tetrahedral structure.

- 29** In graphite, electrons are [CBSE AIPMT 1993, 97]

(a) localised on each C-atom
(b) localised on every third C-atom
(c) spread out between the structure
(d) Both (b) and (c)

Ans. (d)

Structure of graphite consist of a two dimensional sheet like network joined together in hexagonal rings. These layers are held together by weak van der Waals' forces. In graphite each carbon atom is bonded to three others, forming sp^2 hybrid bonds. The fourth electron forms a π -bond.

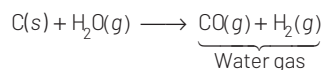
Graphite is a conductor of electricity which is due to the fact that all the carbon bonds being not satisfied. Thus, some of the electrons are free to move through the crystal.

- 30** Water gas is produced by [CBSE AIPMT 1992]

(a) passing steam through a red hot coke bed
(b) saturating hydrogen with moisture
(c) mixing oxygen and hydrogen in the ratio of 1:2
(d) heating a mixture of CO_2 and CH_4 in petroleum refineries

Ans. (a)

Water gas is produced when steam is passed over red hot coke beds.



- 31** Which of the following types of forces bind together the carbon atoms in diamond? [CBSE AIPMT 1992]

(a) Ionic
(b) Covalent
(c) Dipolar
(d) van der Waals'

Ans. (b)

In diamond, each carbon atom undergoes sp^3 hybridisation and is covalently bonded to three other carbon atoms by single bonds.

- 32** Glass is a [CBSE AIPMT 1991]

(a) liquid
(b) solid
(c) supercooled liquid
(d) transparent-organic polymer

Ans. (c)

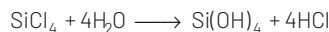
Glass is an example of amorphous solid. It is also known as **supercooled liquid**. Glass have short range order of constituents.

- 33** The substance used as a smoke screen in warfare is [CBSE AIPMT 1989]

(a) SiCl_4
(b) PH_3
(c) PCl_5
(d) acetylene

Ans. (a)

Silicon chloride is easily hydrolysed to give white fumes, so it is used as a smoke screen in warfare.



TOPIC 3 Group 15 Elements

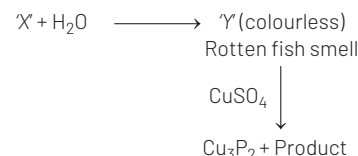
- 34** A compound 'X' upon reaction with H_2O produced a colourless gas 'Y' with rotten fish smell. Gas 'Y' is absorbed in a solution of CuSO_4 to give Cu_3P_2 as one of the products. Predict the compound 'X'

[NEET (Odisha) 2019]

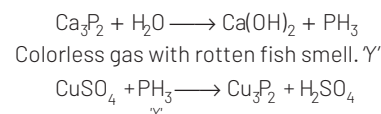
(a) Ca_3P_2
(b) NH_4Cl
(c) As_2O_3
(d) $\text{Ca}_3(\text{PO}_4)_2$

Ans. (a)

The given road map problem is



As compound 'X' produces a colorless gas 'Y' with rotten fish smell, it can be Ca_3P_2 (calcium phosphide). The reaction takes place as follows :

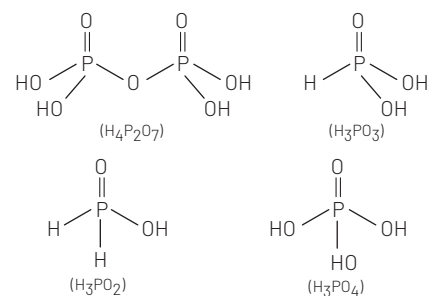


- 35** Which of the following oxoacids of phosphorus has strongest reducing property? [NEET (National) 2019]

(a) $\text{H}_4\text{P}_2\text{O}_7$
(b) H_3PO_3
(c) H_3PO_2
(d) H_3PO_4

Ans. (c)

P—H bonds found in phosphorus acids have reducing properties. Thus, reducing property is directly proportional to number of P—H bonds. The structures of given oxoacids of phosphorus are as follows :



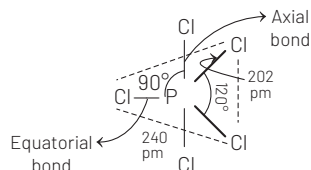
H_3PO_2 contains 2P—H bonds which is maximum among given options. Thus, H_3PO_2 has strongest reducing property.

- 36** Identify the incorrect statement related to PCl_5 from the following: [NEET (National) 2019]

(a) Two axial P—Cl bonds make an angle of 180° with each other
(b) Axial P—Cl bonds are longer than equatorial P—Cl bonds
(c) PCl_5 molecule is non-reactive
(d) Three equatorial P—Cl bonds make an angle of 120° with each other

Ans. (c)

In gaseous and liquid phases, PCl_5 has a trigonal bipyramidal structure with sp^3d -hybridisation.



Due to presence of longer and weaker axial bonds PCl_5 is a reactive molecule. Hence, statement in option (c) is incorrect while the remaining options contain correct statements.

37 The correct order of N-compounds in its decreasing order of oxidation states is [NEET 2018]

- (a) HNO_3 , NH_4Cl , NO , N_2
 (b) HNO_3 , NO , NH_4Cl , N_2
 (c) HNO_3 , NO , N_2 , NH_4Cl
 (d) NH_4Cl , N_2 , NO , HNO_3

Ans. (c)

Let the oxidation state of nitrogen in each of the given N-compounds be x .

(i) HNO_3 : $+1 + x + 3(-2) = 0$
 $x = +5$

$\therefore$ Oxidation state of N in HNO_3 is +5.

(ii) NO : $x + 1(-2) = 0$
 $x = +2$

$\therefore$ Oxidation state of N in NO is +2.

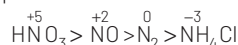
(iii) NH_4Cl : $x + 4(+1) + 1(-1) = 0$
 $x = -3$

$\therefore$ Oxidation state of N in NH_4Cl is -3.

(iv) N_2 : $x = 0$ [$\because \text{N}_2$ is present in elemental state]

$\therefore$ Oxidation state of N in N_2 is 0.

Thus, the correct decreasing order of oxidation states of given N-compounds will be



38 Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity? [NEET 2018]

- (a) N_2O (b) NO_2
 (c) N_2O_5 (d) NO

Ans. (c)

Nitrous oxide (N_2O), nitrogen dioxide (NO_2) and nitric oxide (NO) are the common pollutant introduced into the atmosphere.

N_2O occurs naturally in environment. NO and NO_2 causes considerable amount of air pollution. They are given off in car

exhaust fumes and when fossil fuels are burnt as well as produced during thunderstorms. In each case NO is formed first and then NO_2 .

39 The species, having bond angles of 120° is [NEET 2017]

- (a) PH_3 (b) ClF_3 (c) NCl_3 (d) BCl_3

Ans. (d)

The species having bond angles of 120° is BCl_3 . It is sp^2 -hybridised and central atom does not have any lone pair of electrons.

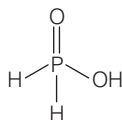
Chemical formula	Species	Bond angle
PH_3	 (Pyramidal)	93.5°
ClF_3	 (T-shaped)	90°
NCl_3	 (Pyramidal)	107.8°
BCl_3	 (Trigonal planar)	120°

40 Which is the correct statement for the given acids? [NEET 2016, Phase I]

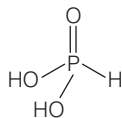
- (a) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid
 (b) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid
 (c) Both are triprotic acids
 (d) Both are diprotic acids

Ans. (a)

Phosphinic acid



Phosphonic acid



Due to the presence of one replaceable proton in phosphinic acid, it is monoprotic acid. And due to presence of two replaceable proton in phosphonic acid, it is diprotic acid.

41 Among the following, which one is a wrong statement?

[NEET 2016, Phase II]

- (a) PH_5 and BiCl_5 do not exist
 (b) $p\pi-d\pi$ bonds are present in SO_2
 (c) SeF_4 and CH_4 have same shape
 (d) I_3^+ has bent geometry

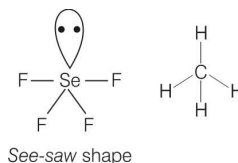
Ans. (c)

PH_5 does not exist due to very less electronegativity difference between P and H. Hydrogen is slightly more electronegative than phosphorus, thus could not hold significantly the sharing electrons.

On the other hand, BiCl_5 does not exist due to inert pair effect.

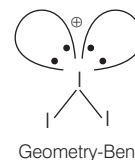
On moving down the group, +5 oxidation state becomes less stable while +3 oxidation state becomes more stable.

In SO_2 , $p\pi-d\pi$ and $p\pi-p\pi$ both types of bonds are present



See-saw shape

Thus, SeF_4 and CH_4 do not have same shape.



Geometry-Bent

Thus, option (c) is incorrect statement.

42 Maximum bond angle at nitrogen is present in which of the following? [CBSE AIPMT 2015]

- (a) NO_2 (b) NO_2^-
 (c) NO_2^+ (d) NO_3^-

Ans. (c)

Species	Hybridisation	Bond angle
NO_2	sp	less than 120°
NO_2^-	sp^2	115.4°
NO_2^+	sp (linear)	180°
NO_3^-	sp^2	120°

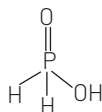
So, NO_2^+ has maximum bond angle.

43 Strong reducing behaviour of H_3PO_2 is due to [CBSE AIPMT 2015]

- (a) presence of one —OH group and two P—H bonds
- (b) high electron gain enthalpy of phosphorus
- (c) high oxidation state of phosphorus
- (d) presence of two —OH groups and one P—H bond

Ans. (a)

The oxy acid of phosphorus which contain P—H bond act as a reducing agent or reductant.



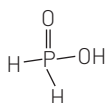
In H_3PO_2 one —OH group and two P—H bonds are present.

44 Which of the following statements is not valid for oxoacids of phosphorus? [CBSE AIPMT 2012]

- (a) Orthophosphoric acid is used in the manufacture of triple superphosphate
- (b) Hypophosphorous acid is a diprotic acid
- (c) All oxoacids contain tetrahedral four coordinated phosphorus
- (d) All oxoacids contain at least one $\text{P}=\text{O}$ unit and one P—OH group

Ans. (b)

Hypophosphorous acid, H_3PO_2 , has the following structure.



As it contains only one replaceable H-atom (that is attached with O, not with P directly) so it is a monoprotic acid.

All other given statements are true.

45 Oxidation states of P in $\text{H}_4\text{P}_2\text{O}_5$, $\text{H}_4\text{P}_2\text{O}_6$ and $\text{H}_4\text{P}_2\text{O}_7$, respectively are [CBSE AIPMT 2010]

- (a) +3, +5 and +4
- (b) +5, +3 and +4
- (c) +5, +4 and +3
- (d) +3, +4 and +5

Ans. (d)

Oxidation state of H is +1 and that of O is -2.

Let the oxidation state of P in the given compounds is x.

In $\text{H}_4\text{P}_2\text{O}_5$

$$(+1) \times 4 + 2 \times x + (-2) \times 5 = 0$$

$$4 + 2x - 10 = 0$$

$$2x = 6$$

$$x = +3$$

$\therefore$

In $\text{H}_4\text{P}_2\text{O}_6$

$$(+1) \times 4 + 2 \times x + (-2) \times 6 = 0$$

$$4 + 2x - 12 = 0$$

$$2x = 8$$

$\therefore$

$$x = +4$$

In $\text{H}_4\text{P}_2\text{O}_7$

$$(+1) \times 4 + 2 \times x + (-2) \times 7 = 0$$

$$4 + 2x - 14 = 0$$

$$2x = 10$$

$\therefore$

$$x = +5$$

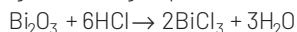
Thus, the oxidation states of P in $\text{H}_4\text{P}_2\text{O}_5$, $\text{H}_4\text{P}_2\text{O}_6$ and $\text{H}_4\text{P}_2\text{O}_7$ are +3, +4 and +5 respectively.

46 Which of the following is the most basic oxide? [CBSE AIPMT 2006]

- (a) Al_2O_3
- (b) Sb_2O_3
- (c) Bi_2O_3
- (d) SeO_2

Ans. (c)

In Al_2O_3 , Sb_2O_3 , Bi_2O_3 and SeO_2 , Bi_2O_3 is most basic oxide. As across the period basic nature of oxide decreases and on moving down the group it increases.



47 Zn gives H_2 gas with H_2SO_4 and

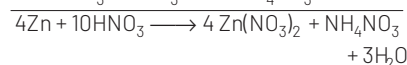
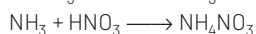
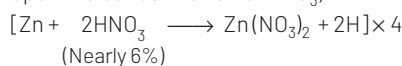
HCl but not with HNO_3 because

[CBSE AIPMT 2002]

- (a) Zn act as oxidising agent when react with HNO_3
- (b) HNO_3 is weaker acid than H_2SO_4 and HCl
- (c) In electrochemical series Zn is placed above hydrogen
- (d) NO_3^- is reduced in preference to hydronium ion

Ans. (d)

Zn have lower value of E°_{cell} and easily gives oxidation. Zn is present above H_2 in electrochemical series. So, it liberates hydrogen gas from dil. $\text{HCl}/\text{H}_2\text{SO}_4$. But HNO_3 is an oxidising agent. The hydrogen obtained in this reaction is converted into H_2O . In HNO_3 , NO_3^- ion is reduced and give NH_4NO_3 , N_2O , NO and NO_2 (based upon the concentration of HNO_3)



48 Nitrogen forms N_2 , but phosphorus when form P_2 readily converted into P_4 , reason is

[CBSE AIPMT 2001]

- (a) triple bond present between phosphorus atom
- (b) $p\pi-p\pi$ bonding is weak
- (c) $p\pi-p\pi$ bonding is strong
- (d) multiple bond form easily

Ans. (b)

Nitrogen form N_2 (i.e. $\text{N} \equiv \text{N}$) but phosphorus form P_2 , it is at a time convert in P_4 , because in P_2 , $p\pi-p\pi$ bonding is present which is a weaker bonding due to larger size.

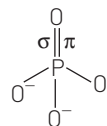
49 Among the following ions the $p\pi-d\pi$ overlap could be present in

[CBSE AIPMT 2000]

- (a) NO_2^-
- (b) NO_3^-
- (c) PO_4^{3-}
- (d) CO_3^{2-}

Ans. (c)

In P—O bond, π -bond is formed by the sidewise overlapping of d-orbital of P and p-orbital of oxygen. Hence, it is formed by $p\pi$ and $d\pi$ -overlapping.



In nitrogen and carbon, no vacant d-orbital is present. So, they do not form $p\pi-d\pi$ bond.

50 Which of the following phosphorus is the most reactive?

[CBSE AIPMT 1999]

- (a) Red phosphorus
- (b) White phosphorus
- (c) Scarlet phosphorus
- (d) Violet phosphorus

Ans. (b)

White phosphorus has low ignition temperature. So, it is most reactive.

51 Which of the following is most acidic? [CBSE AIPMT 1999]

- (a) N_2O_5
- (b) P_2O_5
- (c) As_2O_5
- (d) Sb_2O_5

Ans. (a)

Acidic nature of oxides decreases down a group. So, N_2O_5 is most acidic.

Another reason of acidic strength of N_2O_5 is that the electronegativity of N is maximum in the given Vth group elements. As we know that on increasing the electronegative character, acidic nature increases.

52 Repeated use of which one of the following fertilizers would increase the acidity of the soil?

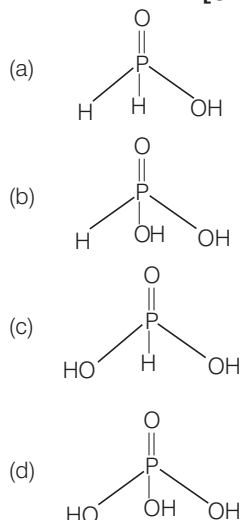
- (a) Urea [CBSE AIPMT 1998]
 (b) Superphosphate of lime
 (c) Ammonium sulphate
 (d) Potassium nitrate

Ans. (c)

The fertilizer ammonium sulphate is a salt of weak base and strong acid, thus its aqueous solution is acidic, so it produces acidity.

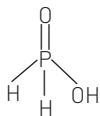
53 The structural formula of hypophosphorous acid is

[CBSE AIPMT 1997]



Ans. (a)

Hypophosphorous acid (H_3PO_2) is monobasic acid, so its structure is



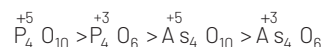
54 Which of the following oxides will be the least acidic?

[CBSE AIPMT 1996]

- (a) As_4O_6 (b) As_4O_{10}
 (c) P_4O_{10} (d) P_4O_6

Ans. (a)

As the oxidation state of central atom increases the acidic character increases, so the correct order of acidic character is



and hence, As_4O_6 is least acidic.

55 An aqueous solution of sodium carbonate absorbs NO and NO_2 to give

[CBSE AIPMT 1996]

- (a) $\text{CO}_2 + \text{NaNO}_3$
 (b) $\text{CO}_2 + \text{NaNO}_2$
 (c) $\text{NaNO}_2 + \text{CO}$
 (d) $\text{NaNO}_3 + \text{CO}$

Ans. (c)



56 Which of the following fluorides does not exist? [CBSE AIPMT 1993]

- (a) NF_5 (b) PF_5
 (c) AsF_5 (d) SbF_5

Ans. (a)

Nitrogen does not form pentahalide because it does not have vacant d-orbital.

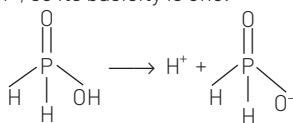
57 H_3PO_2 is the molecular formula of an acid of phosphorous. Its name and basicity respectively are

[CBSE AIPMT 1992]

- (a) phosphorous acid and 2
 (b) hypophosphorous acid and 2
 (c) hypophosphorous acid and one
 (d) hypophosphoric acid and two

Ans. (c)

The name of H_3PO_2 is hypophosphorous acid when dissolve in water, it gives only one H^+ , so its basicity is one.



58 Nitrogen is relatively inactive element because

[CBSE AIPMT 1992]

- (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

Ans. (d)

Dinitrogen (N_2) is chemically unreactive at ordinary temperature. The N—N bond in nitrogen molecule is a triple bond ($\text{N} \equiv \text{N}$) with a bond distance of 109.8 pm and bond dissociation energy of 946 kJ mol^{-1} . The low reactivity of nitrogen is due to fairly high bond dissociation energy of the molecule.

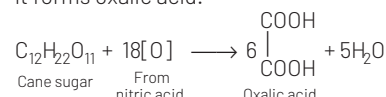
59 Cane sugar on reaction with nitric acid gives

[CBSE AIPMT 1992]

- (a) CO_2 and SO_2 (b) 2HCOOH
 (c) $(\text{COOH})_2$ (d) no reaction

Ans. (c)

When nitric acid reacts with cane sugar, it forms oxalic acid.



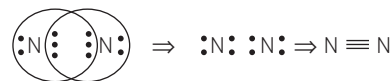
60 Number of electrons shared in the formation of nitrogen molecule is

[CBSE AIPMT 1992]

- (a) 6 (b) 10
 (c) 2 (d) 8

Ans. (a)

Nitrogen molecule is formed by sharing of three electrons by each nitrogen, so total number of electrons shared are six.



61 Which is used in the laboratory for fast drying of neutral gases?

[CBSE AIPMT 1992]

- (a) P_2O_5
 (b) Anhyd. CaCl_2
 (c) Activated charcoal
 (d) Na_3PO_4

Ans. (a)

P_2O_5 absorb moisture, so it is used as a drying agent for neutral gases.

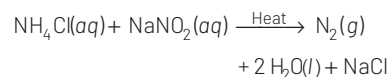
62 Pure nitrogen is prepared in the laboratory by heating a mixture of

[CBSE AIPMT 1991]

- (a) $\text{NH}_4\text{OH} + \text{NaCl}$ (b) $\text{NH}_4\text{NO}_3 + \text{NaCl}$
 (c) $\text{NH}_4\text{Cl} + \text{NaOH}$ (d) $\text{NH}_4\text{Cl} + \text{NaNO}_2$

Ans. (d)

In the laboratory dinitrogen is prepared by heating an aqueous solution containing an equivalent amount of ammonium chloride and sodium nitrite.



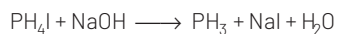
63 $\text{PH}_4\text{I} + \text{NaOH}$ forms

[CBSE AIPMT 1991]

- (a) PH_3 (b) NH_3
 (c) P_4O_6 (d) P_4O_{10}

Ans. (a)

When PH_4I and NaOH react, phosphine gas is obtained.



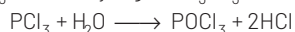
64 PCl_3 reacts with water to form

[CBSE AIPMT 1991]

- (a) PH_3 (b) $\text{H}_3\text{PO}_3, \text{HCl}$
(c) POCl_3 (d) H_3PO_4

Ans. (b)

PCl_3 is easily hydrolysed by water to give POCl_3 and finally it gives H_3PO_3 and HCl .



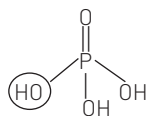
65 Basicity of orthophosphoric acid is

[CBSE AIPMT 1991]

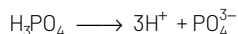
- (a) 2 (b) 3
(c) 4 (d) 5

Ans. (b)

Orthophosphoric acid (H_3PO_4) have the following structure



It is clear from the structure that it contains three replaceable hydrogen atoms, so it gives three H^+ ions on dissolution in water. So, the basicity of H_3PO_4 is three.



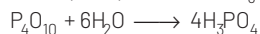
66 P_2O_5 is heated with water to give

[CBSE AIPMT 1991]

- (a) hypophosphorous acid
(b) phosphorous acid
(c) hypophosphoric acid
(d) orthophosphoric acid

Ans. (d)

When P_2O_5 (or P_4O_{10}) is heated with water, it form orthophosphoric acid (H_3PO_4).



67 Aqueous solution of ammonia consists of

[CBSE AIPMT 1991]

- (a) H^+
(b) OH^-
(c) NH_4^+
(d) NH_4^+ and OH^-

Ans. (d)

When ammonia dissolve in water, it form ammonium hydroxide which is ionise as given below



68 Which of the following statements is not correct for nitrogen?

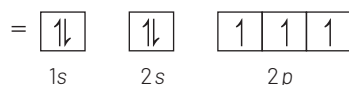
[CBSE AIPMT 1990]

- (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

Ans. (b)

Nitrogen does not have vacant d -orbital in its outermost shell.

$$\text{N}(7) = 1s^2, 2s^2 2p^3$$



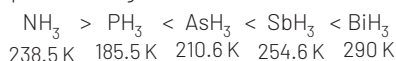
69 Which one has the lowest boiling point?

[CBSE AIPMT 1989]

- (a) NH_3 (b) PH_3
(c) AsCl_3 (d) SbH_3

Ans. (b)

In the hydrides of group 15, the boiling points changes as



$\therefore$ Generally mass increases then boiling point increases.

The higher boiling point of NH_3 is due to excessive hydrogen bonding, so PH_3 have lowest boiling point among hydrides of group number 15, i.e. nitrogen family.

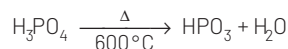
70 When orthophosphoric acid is heated to 600°C , the product formed is

[CBSE AIPMT 1989]

- (a) PH_3 (b) P_2O_5 (c) H_3PO_3 (d) HPO_3

Ans. (d)

When orthophosphoric acid (H_3PO_4) is heated and dehydration takes place. It form metaphosphoric acid (HPO_3).



71 Each of the following is true for white and red phosphorus except that they

[CBSE AIPMT 1989]

- (a) both are 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

Ans. (a)

White and red phosphorus are the main allotropes of phosphorus. White phosphorus is soluble in carbon disulphide whereas red phosphorus is insoluble in carbon disulphide.

72 Which of the following compound does not exist? [CBSE AIPMT 1989]

- (a) NCl_5 (b) AsF_5
(c) SbCl_5 (d) PF_5

Ans. (a)

Nitrogen does not form NCl_5 (nitrogen pentachloride) because nitrogen does not have vacant d -orbital, so it can form only NCl_3 .

73 Which of the following is a nitric acid anhydride? [CBSE AIPMT 1988]

- (a) NO (b) NO_2
(c) N_2O_5 (d) N_2O_3

Ans. (c)

Dinitrogen pentaoxide (N_2O_5) is prepared by dehydrating the concentrated nitric acid with phosphorus pentoxide.



So, N_2O_5 is regarded as anhydride of HNO_3 .

TOPIC 4 Group 16 Elements

74 In which one of the following arrangements the given sequence is not strictly according to the properties indicated against it?

[NEET 2021]

- (a) $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$: Increasing acidic strength
(b) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$: Increasing $\text{p}K_a$ values
(c) $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3$: Increasing acidic character
(d) $\text{CO}_2 < \text{SiO}_2 < \text{SnO}_2 < \text{PbO}_2$: Increasing oxidising power

Ans. (b)

$\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$; Down the group, size of atom increases, bond length decreases and bond enthalpy decreases. So, acidic strength increases.

$\therefore$ The given sequence is correct

$\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se} > \text{H}_2\text{Te}$, $\text{p}K_a$ is inversely proportional to acidic strength. So, $\text{p}K_a$ decreases.

$\therefore$ The given sequence is incorrect.

$\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3$; Acidic character increases down the group,

$\therefore$ The given sequence is correct.

$\text{CO}_2 < \text{SiO}_2 < \text{SnO}_2 < \text{PbO}_2$; on moving down the group oxidising power increases.

$\therefore$ The given sequence is correct.

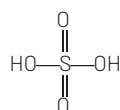
75 Which of the following oxoacid of sulphur has —O—O— linkage?
[NEET (Sep.) 2020]

- (a) H_2SO_4 , sulphuric acid
(b) $\text{H}_2\text{S}_2\text{O}_8$, peroxodisulphuric acid
(c) $\text{H}_2\text{S}_2\text{O}_7$, pyrosulphuric acid
(d) H_2SO_3 , sulphurous acid

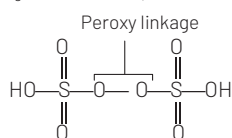
Ans. (b)

The structure of given sulphur oxyacids are :

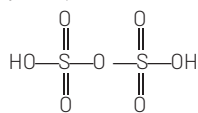
- H_2SO_4 (Sulphuric acid) $\Rightarrow$



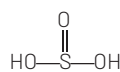
- $\text{H}_2\text{S}_2\text{O}_8$ (Peroxodisulphuric acid) $\Rightarrow$



- $\text{H}_2\text{S}_2\text{O}_7$ (Pyrosulphuric acid) $\Rightarrow$
- $\text{H}_2\text{S}_2\text{O}_7$ (Pyrosulphuric acid) $\Rightarrow$



- H_2SO_3 (Sulphurous acid) $\Rightarrow$



76 Match the following.

	Oxide	Nature
A.	CO	(i) Basic
B.	BaO	(ii) Neutral
C.	Al_2O_3	(iii) Acidic
D.	Cl_2O_7	(iv) Amphoteric

Which of the following is correct option?
[NEET (Sep.) 2020]

- A B C D A B C D
(a) (ii) (i) (iv) (iii) (b) (iii) (iv) (i) (ii)
(c) (iv) (iii) (ii) (i) (d) (i) (ii) (iii) (iv)

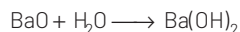
Ans. (a)

The correct matching is :

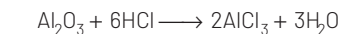
(A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(A) **CO** It is a neutral oxide and almost insoluble in water.

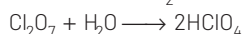
(B) **BaO** It is basic oxide.



(C) **Al_2O_3** It is an amphoteric oxide, because it reacts with both acids and alkalis.



(D) **Cl_2O_7** It is an acidic oxide and produces a very strong acid, perchloric acid in H_2O .

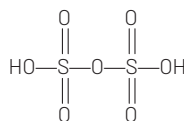


77 Identify the correct formula of oleum from the following
[NEET (Odisha) 2019]

- (a) $\text{H}_2\text{S}_2\text{O}_7$ (b) H_2SO_3
(c) H_2SO_4 (d) $\text{H}_2\text{S}_2\text{O}_8$

Ans. (a)

The correct formula of oleum is $\text{H}_2\text{S}_2\text{O}_7$ which is also known as pyrosulphuric acid.



78 Match the oxide given in column A with its property given in column B. Which of the following options has all correct pairs?
[NEET (Odisha) 2019]

Column-A	Column-B
1. Na_2O	i. Neutral
2. Al_2O_3	ii. Basic
3. N_2O	iii. Acidic
4. Cl_2O_7	iv. Amphoteric

- 1 2 3 4 1 2 3 4
(a) (ii), (i), (iv), (iii) (b) (iii), (ii), (i), (iv)
(c) (i), (ii), (ii), (iii) (d) (ii), (iv), (i), (iii)

Ans. (d)

Key Idea Metal oxides are basic, non-metal oxides are acidic while semi-metal oxides are amphoteric in nature. Thus, the basic character of oxides decreases across the period and increases down the group.

The correct match of oxide with its property are as follows:

Na_2O - Basic Al_2O_3 - Amphoteric
 N_2O - Neutral Cl_2O_7 - Acidic

Thus, option (d) is correct.

79 Which is the correct thermal stability order for H_2E ($\text{E} = \text{O}, \text{S}, \text{Se}, \text{Te}$ and Po)?
[NEET (National) 2019]

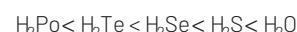
- (a) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$
(b) $\text{H}_2\text{Po} < \text{H}_2\text{Te} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{O}$
(c) $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po} < \text{H}_2\text{O} < \text{H}_2\text{S}$
(d) $\text{H}_2\text{S} < \text{H}_2\text{O} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$

Ans. (b)

For group 16 elements, the hydrides with high molar mass (e.g. H_2Po) are less thermally stable than hydride with lower molar mass (e.g. H_2O). This is due to the increase in size of central atom which results to the weakening of $\text{M}-\text{H}$ bond due to increased bond length.

Thus, the correct order of thermal stability for

H_2E ($\text{E} = \text{O}, \text{S}, \text{Se}, \text{Te}$ and Po) is as follows:

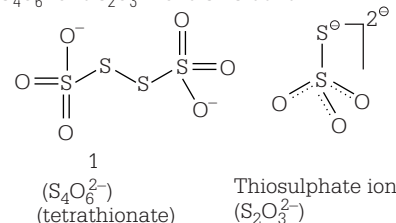


80 In which pair of ions both the species contain S—S bond?
[NEET 2017]

- (a) $\text{S}_2\text{O}_7^{2-}$, $\text{S}_2\text{O}_3^{2-}$
(b) $\text{S}_4\text{O}_6^{2-}$, $\text{S}_2\text{O}_3^{2-}$
(c) $\text{S}_2\text{O}_7^{2-}$, $\text{S}_2\text{O}_8^{2-}$
(d) $\text{S}_4\text{O}_6^{2-}$, $\text{S}_2\text{O}_7^{2-}$

Ans. (b)

$\text{S}_4\text{O}_6^{2-}$ and $\text{S}_2\text{O}_3^{2-}$ have S—S bond

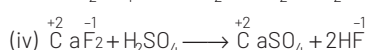
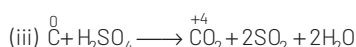
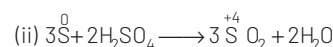
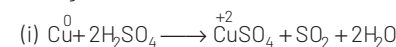


81 Hot concentrated sulphuric acid is a moderately strong oxidising agent. Which of the following reaction does not show oxidising behaviour?
[NEET 2016, Phase II]

- (a) $\text{Cu} + 2\text{H}_2\text{SO}_4 \longrightarrow \text{CuSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$
(b) $3\text{S} + 2\text{H}_2\text{SO}_4 \longrightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$
(c) $\text{C} + 2\text{H}_2\text{SO}_4 \longrightarrow \text{CO}_2 + 2\text{SO}_2 + 2\text{H}_2\text{O}$
(d) $\text{CaF}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{CaSO}_4 + 2\text{HF}$

Ans. (d)

Key Idea An oxidising agent is a species, which oxidises the other species and itself gets reduced.



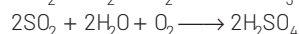
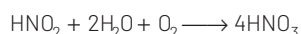
In reaction (iv), oxidation number of elements remains unchanged. Thus, in this reaction, H_2SO_4 does not act as an oxidising agent.

- 82** Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but not by the other? [CBSE AIPMT 2015]

- (a) Forms acid-rain
(b) Is a reducing agent
(c) Is soluble in water
(d) Is used as a food-preservative

Ans. (a)

Nitrogen dioxide and sulphur dioxide forms acid rain. 'Acid rain' is the rain water containing sulphuric acid and nitric acid.



- (b) NO_2 and SO_2 act as a good reducing agent
e.g. SO_2 reduces halogens to halogen acid
 $\text{Cl}_2 + 2\text{H}_2\text{O} + \text{SO}_2 \longrightarrow 2\text{HCl} + \text{H}_2\text{SO}_4$
(c) NO_2 and SO_2 both are soluble in water.
(d) SO_2 is used in the manufacture of sodium bisulphite (NaHSO_3) which is used as a preservative for jams, jellies and squashes.

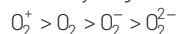
- 83** Decreasing order of stability of O_2 , O_2^- , O_2^+ and O_2^{2-} is [CBSE AIPMT 2015]

- (a) $\text{O}_2^+ > \text{O}_2 > \text{O}_2^- > \text{O}_2^{2-}$
(b) $\text{O}_2^{2-} > \text{O}_2^- > \text{O}_2 > \text{O}_2^+$
(c) $\text{O}_2 > \text{O}_2^+ > \text{O}_2^{2-} > \text{O}_2^-$
(d) $\text{O}_2^- > \text{O}_2^{2-} > \text{O}_2^+ > \text{O}_2$

Ans. (a)

Order of stability $\propto$ bond order

$\therefore$ Order of the stability of given species,



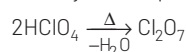
Bond order 2.5 2 1.5 1

- 84** Which of the statements given below is incorrect? [CBSE AIPMT 2015]

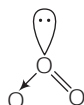
- (a) Cl_2O_7 is an anhydride of perchloric acid
(b) O_3 molecule is bent
(c) ONF is isoelectronic with NO_2
(d) OF_2 is an oxide of fluorine

Ans. (d)

- (a) Cl_2O_7 is an anhydride of perchloric acid

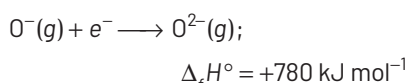
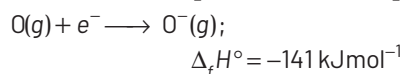


- (b) Shape of O_3 molecule is bent.



- (c) Number of electrons in ONF = 24
Number of electrons in NO_2 = 24
 $\therefore$ ONF and NO_2 both are isoelectronic.
(d) OF_2 is a fluoride of oxygen because electronegativity of fluorine is more than that of oxygen.
 OF_2 = Oxygen difluoride

- 85** The formation of the oxide ion $\text{O}^{2-}(\text{g})$, from oxygen atom requires first an exothermic and then an endothermic step as shown below, [CBSE AIPMT 2015]



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

- (a) electron repulsion outweighs the stability gained by achieving noble gas configuration
(b) O^- ion has comparatively smaller size than oxygen atom
(c) Oxygen is more electronegative
(d) addition of electron in oxygen result in large size of the ion

Ans. (a)

Since, electron repulsion predominate over the stability gained by achieving noble gas configuration. Hence, formation of O^{2-} in gas phase is unfavourable.

- 86** Acidity of diprotic acids in aqueous solutions increases in the order [CBSE AIPMT 2014]

- (a) $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$
(b) $\text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{Te}$
(c) $\text{H}_2\text{Te} < \text{H}_2\text{S} < \text{H}_2\text{Se}$
(d) $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{S}$

Ans. (a)

Acidic strength of hydrides increases as the size of central atom increases which weakens the M—H bond. Since, the size increases from S to Te thus acidic strength follows the order.



Acidic nature

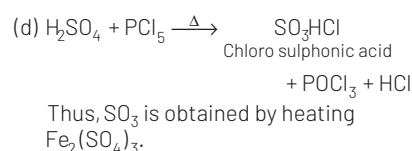
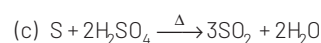
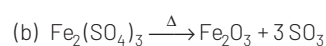
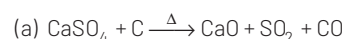
$$\propto \frac{1}{\text{Bond dissociation enthalpy}}$$

S to Te size increases, bond dissociation enthalpy decreases and acidic nature increases.

- 87** Sulphur trioxide can be obtained by which of the following reaction? [CBSE AIPMT 2012]

- (a) $\text{CaSO}_4 + \text{C} \xrightarrow{\Delta}$
(b) $\text{Fe}_2(\text{SO}_4)_3 \xrightarrow{\Delta}$
(c) $\text{S} + \text{H}_2\text{SO}_4 \xrightarrow{\Delta}$
(d) $\text{H}_2\text{SO}_4 + \text{PCl}_5 \xrightarrow{\Delta}$

Ans. (b)

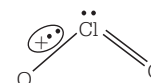


- 88** Which one of the following oxides is expected to exhibit paramagnetic behaviour? [CBSE AIPMT 2005]

- (a) CO_2 (b) SO_2
(c) ClO_2 (d) SiO_2

Ans. (c)

ClO_2 shows paramagnetic character due to presence of unpaired electron in its structure.



- 89** The oxidation states of sulphur in the anions SO_3^{2-} , $\text{S}_2\text{O}_4^{2-}$ and $\text{S}_2\text{O}_6^{2-}$ follows the order [CBSE AIPMT 2003]

- (a) $\text{S}_2\text{O}_4^{2-} < \text{S}_2\text{O}_6^{2-} < \text{SO}_3^{2-}$
(b) $\text{S}_2\text{O}_6^{2-} < \text{S}_2\text{O}_4^{2-} < \text{SO}_3^{2-}$
(c) $\text{S}_2\text{O}_4^{2-} < \text{SO}_3^{2-} < \text{S}_2\text{O}_6^{2-}$
(d) $\text{SO}_3^{2-} < \text{S}_2\text{O}_4^{2-} < \text{S}_2\text{O}_6^{2-}$

Ans. (c)

Oxidation state of S in SO_3^{2-}

$$x + (-2 \times 3) = -2$$

$$x = +6 - 2 = +4$$

Oxidation state of S in $\text{S}_2\text{O}_4^{2-}$

$$2x + (-2 \times 4) = -2$$

$$2x = +8 - 2 = +6$$

$$x = \frac{+6}{2} = +3$$

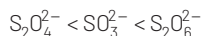
Oxidation state of S in $S_2O_6^{2-}$

$$2x + (-2 \times 6) = -2$$

$$2x = +12 - 2 = 10$$

$$x = \frac{10}{2} = +5$$

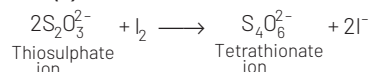
Hence, increasing order of oxidation states of S is



90 Oxidation of thiosulphate by iodine gives [CBSE AIPMT 1996]

- (a) tetrathionate ion
- (b) sulphide ion
- (c) sulphate ion
- (d) sulphite ion

Ans. (a)

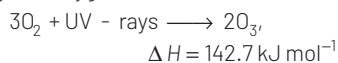


91 About 20 km above the earth, there is an ozone layer. Which one of the following statements about ozone and ozone layer is true? [CBSE AIPMT 1995]

- (a) Ozone is a triatomic linear molecule
- (b) It is harmful as it stops useful radiation
- (c) It is beneficial to us as it stops UV-radiation
- (d) Conversion of O_3 to O_2 is an endothermic reaction

Ans. (c)

Ozone is an allotropic form of oxygen. It is present in the upper atmosphere (about 20 km above the surface of the earth). It is believed to be formed in the upper atmosphere by the action of UV-rays on oxygen as



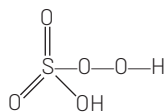
Therefore, UV-rays, which are harmful to human beings are absorbed by oxygen to form ozone. The layer of ozone, thus formed also prevents the remaining UV-rays to reach the earth's surface.

92 The acid which has a peroxy linkage is [CBSE AIPMT 1994]

- (a) sulphurous acid
- (b) pyrosulphuric acid
- (c) dithionic acid
- (d) Caro's acid

Ans. (d)

Peroxomonosulphuric acid, H_2SO_5 is also known as Caro's acid. It has peroxy linkage $-O-O-$ which is confirmed by X-ray studies.



93 Polyanion formation is maximum in [CBSE AIPMT 1994]

- (a) nitrogen
- (b) oxygen
- (c) sulphur
- (d) boron

Ans. (c)

Sulphur has more tendency to form polyanion such as S_3^{2-} , S_4^{2-} and S_5^{2-} because sulphur has more tendency for catenation among the given elements.

94 Oleum is [CBSE AIPMT 1991]

- (a) castor oil
- (b) oil of vitriol
- (c) fuming H_2SO_4
- (d) None of these

Ans. (c)

Disulphuric acid ($H_2S_2O_7$) is called **oleum** or **fuming sulphuric acid**. It is strongest oxidising agent and more powerful dehydrating agent.

95 Which would quickly absorb oxygen? [CBSE AIPMT 1991]

- (a) Alkaline solution of pyrogallol
- (b) Conc. H_2SO_4
- (c) Lime water
- (d) Alkaline solution of $CuSO_4$

Ans. (a)

Alkaline solution of pyrogallol is used to absorb dioxygen gas (O_2).

96 It is possible to obtain oxygen from air by fractional distillation because [CBSE AIPMT 1989]

- (a) oxygen is in a different group of the periodic table from nitrogen
- (b) oxygen is more reactive than nitrogen
- (c) oxygen has higher boiling point than nitrogen
- (d) oxygen has a lower density than nitrogen

Ans. (c)

Oxygen gas is prepared by fractional distillation of air. During this process, dinitrogen with less boiling point (78 K) distills as vapours while dioxygen with higher boiling point (90 K) remains in the liquid state and can be separated.

97 The gases respectively absorbed by alkaline pyrogallol and oil of cinnamon are [CBSE AIPMT 1989]

- (a) O_3 , CH_4
- (b) O_2 , O_3
- (c) SO_2 , CH_4
- (d) N_2O , O_3

Ans. (b)

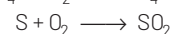
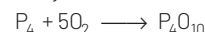
Pyrogallol absorb the oxygen gas and oil of cinnamon absorb the ozone (O_3).

98 Oxygen will directly react with each of the following elements except? [CBSE AIPMT 1989]

- (a) P
- (b) Cl
- (c) Na
- (d) S

Ans. (b)

Out of P, Na, S and Cl, chlorine does not react directly but Na, P and S react with oxygen directly.

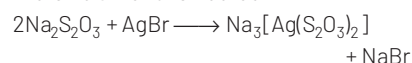


99 Hypo is used in photography to [CBSE AIPMT 1988]

- (a) reduce AgBr grains to metallic silver
- (b) convert metallic silver to silver salt
- (c) remove undecomposed silver bromide as a soluble complex
- (d) remove reduced silver

Ans. (c)

After the developing, the sensitive emulsion of silver bromide is still present on the plate in the parts unaffected by light. Therefore, it is necessary to remove it in order to get the permanent image. This process is called fixing of image. The negative plate after washing is dipped in a fixing solution of sodium thiosulphate (hypo). It dissolves unaffected silver bromide but leaves metallic silver unaffected.



TOPIC 5

Group 17 Elements

100 Statement I Acid strength increases in the order given as
 $HF \ll HCl \ll HBr \ll HI$.

Statement II As the size of the elements F, Cl, Br and 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]

- (a) Both Statement I and Statement II are true.
 (b) Both Statement I and Statement II are false.
 (c) Statement I is true but Statement II is false.
 (d) Statement I is false but Statement II is true.

Ans. (a)

The order of acidic strength is
 $\text{HF} \ll \text{HCl} \ll \text{HBr} \ll \text{HI}$

As we move down the group, the size of atom increases. Thus, the bond length also increases and bond enthalpy decreases. So, it becomes easier to break H-X bond on moving down the group. This results the increase in the acidic strength.

So, both statements I and II are true.

101 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

Which of the following is the correct option?

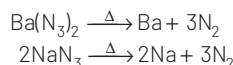
[NEET (National) 2019]

- A B C D
 (a) (ii) (iv) (i) (iii)
 (b) (iii) (iv) (ii) (i)
 (c) (iv) (iii) (ii) (i)
 (d) (i) (ii) (iii) (iv)

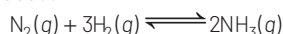
Ans. (c)

The correct match is as follows :

- (A) **Pure nitrogen** Pure nitrogen can be obtained by thermal decomposition of sodium or barium azide.

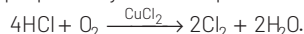


- (B) **Haber's process** On large scale, ammonia is manufactured by Haber's process.



- (C) **Contact process** Sulphuric acid is manufactured by the contact process.

- (D) **Deacon's process** Chlorine is prepared by Deacon's process.



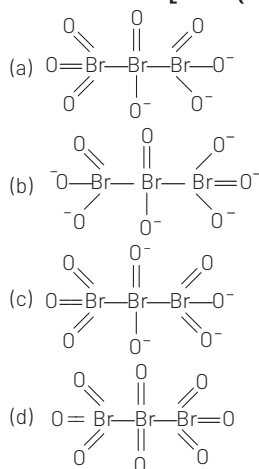
Hence, the correct match is

(A) → (iv), (B) → (iii), (C) → (ii), (D) → (i)

Time Saver If someone know correct match of B, i.e. (iii) then according to the options (c) is the only correct answer as this match is given in this option only.

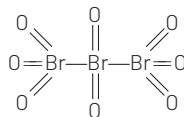
102 The correct structure of tribromooctaoxide is

[NEET (National) 2019]



Ans. (d)

The correct structure of tribromooctaoxide is



In this compound, Br exhibits variable oxidation state. The oxidation state of Br from left to right are +6, +4 and +6, respectively.

103 Which of the following statements is not true for halogens?

[NEET 2018]

- (a) All but fluorine show positive oxidation states
 (b) All are oxidising agents
 (c) All form monobasic oxyacids
 (d) Chlorine has the highest electron-gain enthalpy

Ans. (a)

Fluorine is the most electronegative element and cannot exhibit any positive oxidation state. Other halogens have *d*-orbitals and therefore, can expand their octets and show +1, +3, +5 and +7 oxidation states. Thus, option (a) is incorrect.

Note Fluorine can form an oxoacid, HOF in which oxidation state of F is +1. But HOF is highly unstable compound.

- (b) All halogens are strong oxidising agents as they have strong tendency

to accept an electron. Thus, option (b) is correct.

- (c) All halogens form monobasic oxyacids. Thus, option (c) is also correct.
 (d) Electron gain enthalpy of halogens become less negative down the group. However, the negative electron gain enthalpy of fluorine is less than chlorine due to small size of fluorine atom.

Thus, option (d) is also correct.

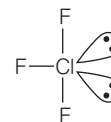
104 In the structure of ClF_3 , the number of lone pairs of electrons on central atom 'Cl' is

[NEET 2018]

- (a) four (b) two
 (c) one (d) three

Ans. (b)

The central atom Cl has seven electrons in the valence shell. Three of these will form electron pair bonds with three fluorine atoms leaving behind four electrons.



Thus, there are three bond pairs and two lone pairs of electrons.

105 Match the interhalogen compounds of Column I with the geometry in Column II and assign the correct code.

[NEET 2017]

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

Code

- A B C D
 (a) (iii) (iv) (i) (ii)
 (b) (iii) (i) (iv) (ii)
 (c) (v) (iv) (iii) (ii)
 (d) (iv) (iii) (ii) (i)

Ans. (b)

Two different halogens may react to form interhalogen compounds as

XX' (ClF, BrF, BrCl, IF, ICl) Linear

XX'_3 (ClF₃, BrF₃, IF₃, ICl₃) Bent T-shaped

XX'_5 (ClF_5 , $BrCl_5$, IF_5)	Square-pyramidal
XX'_7 (IF_7)	Pentagonal bipyramidal

106 Among the following, the correct order of acidity is

[NEET 2016, Phase I, CBSE AIPMT 2005]

- (a) $HClO < HClO_2 < HClO_3 < HClO_4$
 (b) $HClO_2 < HClO < HClO_3 < HClO_4$
 (c) $HClO_4 < HClO_2 < HClO < HClO_3$
 (d) $HClO_3 < HClO_4 < HClO_2 < HClO$

Ans. (a)

As the oxidation state of halogen i.e. $-Cl$ in this case increases, acidity of oxyacid increases.

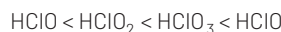
$HClO$: Oxidation state of $Cl = +1$

$HClO_2$: Oxidation state of $Cl = +3$

$HClO_3$: Oxidation state of $Cl = +5$

$HClO_4$: Oxidation state of $Cl = +7$

Therefore, the correct order of acidity would be



107 Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

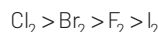
[NEET 2016, Phase I]

- (a) $Cl_2 > Br_2 > F_2 > I_2$
 (b) $Br_2 > I_2 > F_2 > Cl_2$
 (c) $F_2 > Cl_2 > Br_2 > I_2$
 (d) $I_2 > Br_2 > Cl_2 > F_2$

Ans. (a)

As the size increases, bond dissociation enthalpy becomes lower. Also, as the size of atoms get smaller, ion pairs on the two atoms get close enough together to experience repulsion. In case of F_2 , this repulsion is bigger and bond becomes weaker.

Hence, the correct order is



108 The variation of the boiling point of the hydrogen halides is in the order $HF > HI > HBr > HCl$. What explains the higher boiling point of hydrogen fluoride? [CBSE AIPMT 2015]

- (a) The electronegativity of fluorine is much higher than for other elements in the group
 (b) There is strong hydrogen bonding between HF molecules
 (c) The bond energy of HF molecules is greater than in other hydrogen halides
 (d) The effect of nuclear shielding is much reduced in fluorine which polarises the HF molecule

Ans. (b)

Since, there is a strong hydrogen bonding between HF molecules. Hence, boiling point is highest for HF.



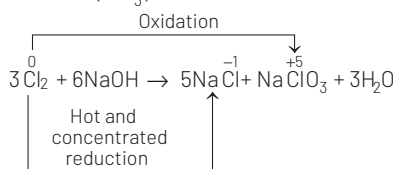
109 When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from

[CBSE AIPMT 2012]

- (a) zero to +1 and zero to -5
 (b) zero to -1 and zero to +5
 (c) zero to -1 and zero to +3
 (d) zero to +1 and zero to -3

Ans. (b)

When chlorine gas reacts with hot and concentrated NaOH solution, it disproportionates into chloride (Cl^-) and chlorate (ClO_3^-) ions.



110 Among the following which is the strongest oxidising agent?

[CBSE AIPMT 2009]

- (a) F_2 (b) Br_2
 (c) I_2 (d) Cl_2

Ans. (a)

Fluorine is the most electronegative element because electronegativity decreases on moving down the group. Hence, it gets reduced readily into F^- ion and is the strongest oxidising agent.

NOTE The electron gain enthalpy of fluorine is less negative than that of chlorine in spite of that fluorine is the strongest oxidising agent. This is due to its low bond dissociation energy and high heat of hydration as compared to those of chlorine.

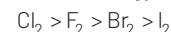
111 Which one of the following arrangements does not give the correct picture of the trends indicated against it?

[CBSE AIPMT 2008]

- (a) $F_2 > Cl_2 > Br_2 > I_2$ Oxidising power
 (b) $F_2 > Cl_2 > Br_2 > I_2$ Electron gain enthalpy
 (c) $F_2 > Cl_2 > Br_2 > I_2$ Bond dissociation energy
 (d) $F_2 > Cl_2 > Br_2 > I_2$ Electronegativity

Ans. (c)

Generally as the size of the atom increases, bond dissociation energy decreases, so in halogens I_2 have lowest bond dissociation energy, but the bond dissociation energy of chlorine is higher than that of fluorine because in fluorine there is a greater repulsion between non-bonding electrons (2p). Hence, the order of bond dissociation energy is



Bond dissociation energy (kJ/mol)

112 Which one of the following ionic species has the greatest proton affinity to form stable compound?

[CBSE AIPMT 2007]

- (a) HS^- (b) NH_2^-
 (c) F^- (d) I^-

Ans. (c)

Fluorine is the most electronegative element in the periodic table. So, it has the greatest proton affinity to form stable compounds.

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

[CBSE AIPMT 2006]

- (a) $F_2 > Cl_2 > Br_2 > I_2$ Oxidising power
 (b) $HI > HBr > HCl > HF$ acidic property in water
 (c) $F_2 > Cl_2 > Br_2 > I_2$ Electronegativity
 (d) $F_2 > Cl_2 > Br_2 > I_2$ Bond dissociation energy

Ans. (d)

Incorrect order of bond dissociation energy $F_2 > Cl_2 > Br_2 > I_2$ due to following order of size $I > Br > Cl > F$.

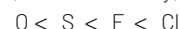
114 Which one of the following arrangements represents the correct order of electron gain enthalpy (with negative sign) of the given atomic species?

[CBSE AIPMT 2005]

- (a) $Cl < F < S < O$
 (b) $O < S < F < Cl$
 (c) $S < O < Cl < F$
 (d) $F < Cl < O < S$

Ans. (b)

The correct order of electron gain enthalpy or (electron affinity) is



Values of electron affinity are (in eV) 1.48, 2.07, 3.45 and 3.61.

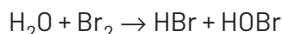
115 Among K, Ca, Fe and Zn, the element which can form more than one binary compound with chlorine is [CBSE AIPMT 2004]

- (a) Fe (b) Zn (c) K (d) Ca

Ans. (a)

A binary compound is that compound which is formed by two different elements. Metals or elements which shows variable oxidation states can form more than one binary compound. In the given elements only Fe shows +2 and +3 oxidation states. So, it can form two binary compounds with chlorine as FeCl_2 and FeCl_3 .

116 Which is the best description of behaviour of bromine in the reaction given below?

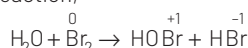


[CBSE AIPMT 2004]

- (a) Only oxidised
(b) Only reduced
(c) Both oxidised and reduced
(d) Only proton accepted

Ans. (c)

In the reaction,



The oxidation number of bromine increases from 0 to +1 and decreases from 0 to -1, due to this reason bromine is both oxidised as well as reduced in the above reaction.

117 Which of the following statement is not true? [CBSE AIPMT 2003]

- (a) HOCl is a stronger acid than HOBr
(b) HF is a stronger acid than HCl
(c) Among halide ions, iodide is the most powerful reducing agent
(d) Fluorine is the only halogen that does not show a variable oxidation state

Ans. (b)

Due to strong $\text{H}-\text{F}$ bond, H^+ ions are not easily removed due to higher electronegativity (EN) of F. Hence more bond dissociation energy required.

$$\text{Acidic nature} \propto \frac{1}{\text{Bond dissociation energy}}$$

So, HF is not a stronger acid than HCl .

118 Which of the following statements is true? [CBSE AIPMT 2002]

- (a) Silicon exhibits 4 coordination number in its compounds
(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 15th group shows only +3 and +5 oxidation states

Ans. (b)

Bond energy of F_2 is less than Cl_2 because in F_2 molecule electron-electron repulsion of 2p-orbital of two fluorine atom is maximum in comparison to the repulsion of 3p-orbitals of two chlorine atom. So, less amount of energy is required to break the bond of F_2 in comparison to Cl_2 .

119 Which reaction is not feasible?

[CBSE AIPMT 2002]

- (a) $2\text{KI} + \text{Br}_2 \rightarrow 2\text{KBr} + \text{I}_2$
(b) $2\text{KBr} + \text{I}_2 \rightarrow 2\text{KI} + \text{Br}_2$
(c) $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$
(d) $2\text{H}_2\text{O} + 2\text{F}_2 \rightarrow 4\text{HF} + \text{O}_2$

Ans. (b)



Reaction is not possible because Br^- ion is not oxidised in Br_2 with I_2 due to higher electrode potential of I_2 than bromine.

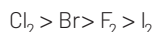
In halogens, fluorine can displace chlorine bromine and iodine, chlorine can displace bromine and iodine and bromine can displace iodine from their salts.

120 Which one of the following arrangements does not truly represent the property indicated against it? [CBSE AIPMT 2000]

- (a) $\text{Br}_2 < \text{Cl}_2 < \text{F}_2$ Oxidising power
(b) $\text{Br}_2 < \text{Cl}_2 < \text{F}_2$ Electronegativity
(c) $\text{Br}_2 < \text{F}_2 < \text{Cl}_2$ Electron affinity
(d) $\text{Br}_2 < \text{Cl}_2 < \text{F}_2$ Bond energy

Ans. (d)

sbond dissociation enthalpy of halogens follows the sequence as :



Enthalpy of dissociation decreases as the bond distance increases from F_2 to I_2 due to a corresponding increase in size of the atom as one move down the group from F to I. However, the $\text{F}-\text{F}$ bond dissociation enthalpy is smaller than that of $\text{Cl}-\text{Cl}$ (even than that of $\text{Br}-\text{Br}$) because F-atom is very small and hence electron-electron repulsion between the lone pairs of electrons are very large.

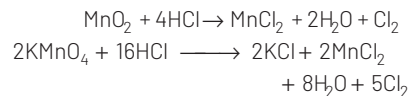
121 Which of the following is used in the preparation of chlorine?

[CBSE AIPMT 1999]

- (a) Only MnO_2
(b) Only KMnO_4

- (c) Both MnO_2 and KMnO_4
(d) Either MnO_2 and KMnO_4

Ans. (c)



122 Which of the following elements has maximum electron affinity?

[CBSE AIPMT 1999]

- (a) Cl (b) Br
(c) I (d) F

Ans. (a)

The electron affinity decreases from $\text{Cl} \rightarrow \text{Br} \rightarrow \text{I}$, i.e. on moving down the group. However, electron affinity of fluorine is unexpected low. It cannot be explained by any simple mechanism. It is probably due to small size of the atom. The addition of an extra electron produces high electron charge density in a relatively compact 2p subshell resulting in strong electron-electron repulsion. The repulsive forces between electrons imply low electron affinity. So, the correct order of electron affinity for halogens is



123 Regarding F^- and Cl^- which of the following statement (s) is/are correct?

- I. Cl^- can give up an electron more easily than F^- .
II. Cl^- is a better reducing agent than F^- .
III. Cl^- is smaller in size than F^- .
IV. F^- can be oxidised more readily than Cl^- .

[CBSE AIPMT 1996]

- (a) I and II (b) I, II and IV
(c) III and IV (d) Only I

Ans. (d)

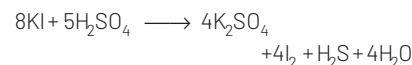
The electronegativity of F^- ion is high, so it accept an electron and Cl^- ion can give an electron more easily. Also the size of F^- is smaller than chloride ion (Cl^-).

124 HI can be prepared by all the following methods except

[CBSE AIPMT 1994]

- (a) $\text{PI}_3 + \text{H}_2\text{O}$ (b) $\text{KI} + \text{H}_2\text{SO}_4$
(c) $\text{H}_2 + \text{I}_2 \xrightarrow{\text{Pt}}$ (d) $\text{I}_2 + \text{H}_2\text{S}$

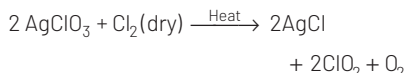
Ans. (b)



125 Which one of the following oxides of chlorine is obtained by passing dry chlorine over silver chlorate at 90°C? [CBSE AIPMT 1994]

- (a) Cl₂O (b) ClO₃
(c) ClO₂ (d) ClO₄

Ans. (c)



126 Which among the following is paramagnetic? [CBSE AIPMT 1994]

- (a) Cl₂O (b) ClO₂ (c) Cl₂O₇ (d) Cl₂O₆

Ans. (b)

ClO₂ contains total valence electrons 19, 7 valence electrons of Cl
6 valence electrons of one oxygen atom
So there must be unpaired electron, thus it is paramagnetic in nature.

127 A solution of KBr is treated with each of the following. Which one would liberate bromine? [CBSE AIPMT 1993]

- (a) Hydrogen iodide
(b) Sulphur dioxide
(c) Chlorine
(d) Iodine

Ans. (c)

Chlorine is good oxidising agent than bromine, so, Cl₂ oxidise Br⁻ to bromine.
 $2\text{KBr} + \text{Cl}_2 \longrightarrow 2\text{KCl} + \text{Br}_2$

128 Which of the following species has four lone pairs of electrons? [CBSE AIPMT 1993]

- (a) I (b) O⁻
(c) Cl⁻ (d) He

Ans. (c)

Cl⁻ has eight electrons in its valence shell, so its Lewis dot structure is $\text{:}\ddot{\text{Cl}}\text{:}^-$ thus, it has four lone pairs of electrons.

129 In the manufacture of bromine from sea water the mother liquor containing bromide is treated with [CBSE AIPMT 1992]

- (a) carbon dioxide
(b) chlorine
(c) iodine
(d) sulphur dioxide

Ans. (b)



Bromide ion when treated with Cl₂ gas then form chloride ion and Br₂ gas liberated.

130 Strongest hydrogen bonding is shown by [CBSE AIPMT 1992]

- (a) water (b) ammonia
(c) HF
(d) hydrogen sulphide

Ans. (c)

HF has strongest hydrogen bonding due to the fact that it has small size and high electronegativity.

131 Elements of which of the following groups will form anions most readily? [CBSE AIPMT 1992]

- (a) Oxygen family (b) Nitrogen family
(c) Halogens (d) Alkali metals

Ans. (c)

Halogens have maximum electron gain enthalpy due to the fact that the atoms of these elements have only one electron less than the stable noble gas ($ns^2 np^6$) configuration. Therefore, they have maximum tendency to accept the electron to form negative ion (anion).

132 Which of the following bonds will be most polar? [CBSE AIPMT 1992]

- (a) N—Cl (b) O—F (c) N—F (d) N—N

Ans. (c)

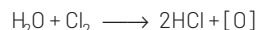
The polar character arises due to the difference in electronegativity. The electronegativity difference of N—F bond is maximum, so it is more polar bond.

133 The bleaching action of chlorine is due to [CBSE AIPMT 1992]

- (a) reduction (b) hydrogenation
(c) chlorination (d) oxidation

Ans. (d)

When chlorine reacts with water it gives nascent oxygen which bleaches the coloured substances.



Coloured substance +

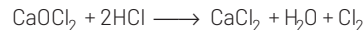


134 Bleaching powder reacts with a few drops of conc. HCl to give [CBSE AIPMT 1989]

- (a) chlorine
(b) hypochlorous acid
(c) calcium oxide
(d) oxygen

Ans. (a)

When bleaching powder reacts with HCl, it forms chlorine gas.



TOPIC 6 Group 18 Elements

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

- (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.

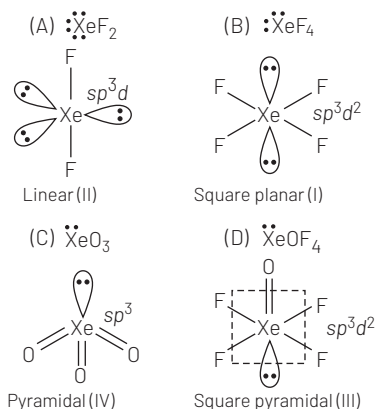
Ans. (b)

- (a) Noble gases or inert gases are sparingly soluble in water as they are non-polar in nature. For solubility the thumb rule is "Like dissolves like".
∴ Statement (a) is correct.
(b) Noble gases have weak interatomic forces (van der Waals' forces). So, they have low melting and boiling points.
∴ Statement (b) is incorrect.
(c) Noble gases have weak London dispersion forces which is weaker than all other intermolecular forces.
∴ Statement (c) is correct.
(d) The last shell of noble gas has 8 electrons. They have stable electronic configuration. So, addition of an electron is difficult. Hence, they have large positive values of electron gain enthalpy.
∴ Statement (d) is correct.

136 Match the compounds of Xe in column I with the molecular structure in column II. [NEET (Oct.) 2020]

Column I	Column II
A. XeF ₂	I. Square planar
B. XeF ₄	II. Linear
C. XeO ₃	III. Square pyramidal
D. XeOF ₄	IV. Pyramidal
A B C D	A B C D
(a) II I III IV	(b) II IV III I
(c) II III I IV	(d) II I IV III

Ans. (d)



Hence, option (d) is correct match.

137 Which of the following pairs of compounds is isoelectronic and isostructural ? [NEET 2017]

- (a) BeCl_2 , XeF_2
 (b) TeI_2 , XeF_2
 (c) IBr_2^- , XeF_2
 (d) IF_3 , XeF_2

Ans. (c)

Key concept Isoelectronic species have equal number of valence electrons. Both IBr_2^- and XeF_2 are linear and number of valence electrons present in both the species is same, i.e. they are also isoelectronic.

S.No.	Compounds	Number of valence electrons	Geometry
1.	BeCl_2	$2 + 14 = 16$	Linear
2.	XeF_2	$8 + 14 = 22$	Linear
3.	TeI_2	$6 + 14 = 20$	Bent or V-shape
4.	IBr_2^-	$7 + 14 + 1 = 22$	Linear
5.	IF_3	$7 + 21 = 28$	T-shape

138 Match the compounds given in column I with the hybridisation and shape given in column II and mark the correct option. [NEET 2016, Phase I]

Column I	Column II
A. XeF_6	1. Distorted octahedral
B. XeO_3	2. Square planar
C. XeOF_4	3. Pyramidal
D. XeF_4	4. Square pyramidal

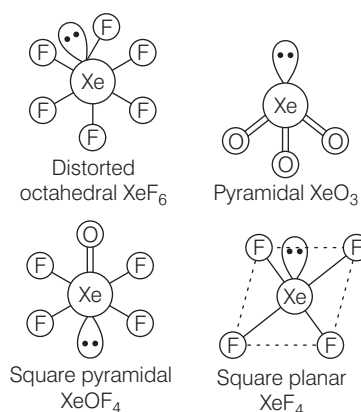
Codes

- A B C D
 (a) 1 2 4 3
 (b) 4 3 1 2
 (c) 4 1 2 3
 (d) 1 3 4 2

Ans. (d)

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

The structure of the xenon compounds are represented below:

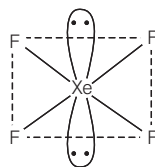


139 The correct geometry and hybridisation for XeF_4 are [NEET 2016, Phase II]

- (a) octahedral, sp^3d^2
 (b) trigonal bipyramidal, sp^3d
 (c) planar triangle, sp^3d^3
 (d) square planar, sp^3d^2

Ans. (a)

Key Idea Geometry is determined by electron pair arrangement whereas shape is determined by arrangement of atoms around the centre atom.



Geometry - octahedral,
 Hybridisation - sp^3d^2
 Thus, option (a) is correct.

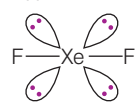
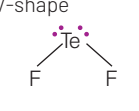
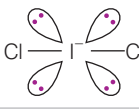
140 XeF_2 is isostructural with

[NEET 2013]

- (a) TeF_2 (b) ICl_2^- (c) SbCl_3 (d) BaCl_2

Ans. (b)

Species having the same number of bond pairs and lone pairs are isostructural (have same structure).

Species	$lp + bp$	Structure
XeF_2	$4lp + 2bp$	Linear 
TeF_2	$2lp + 2bp$	Angular or V-shape 
ICl_2^-	$4lp + 2bp$	Linear 
BaCl_2	$0lp + 2bp$	$\text{Cl}-\text{Ba}-\text{Cl}$ (linear)

Thus, XeF_2 is isostructural with ICl_2^- .

141 Which of the following statements is false? [CBSE AIPMT 1994]

- (a) Radon is obtained from the decay of radium
 (b) Helium is inert gas
 (c) Xenon is the most reactive among the rare gases
 (d) The most abundant rare gas found in the atmosphere is helium

Ans. (d)

The amount of noble gases present in atmosphere (in percent by) is given below:

Element	Abundance (Volume%)
He	5.24×10^{-4}
Ne	1.82×10^{-3}
Ar	0.934
Kr	1.14×10^{-3}
Xe	8.7×10^{-6}

So, argon is most abundant, not helium.

142 Noble gases do not react with other elements because [CBSE AIPMT 1994]

- (a) they are monoatomic
 (b) they are found in abundance
 (c) the size of their atoms is very small
 (d) they are completely paired up and have stable electron shells

Ans. (d)

In general, noble gases are not very reactive. Their chemical inertness is due to the fact that they have completely filled $ns^2 np^6$ electronic configuration of their valence shells. The other reasons are very high ionisation enthalpy and almost zero electron affinity.