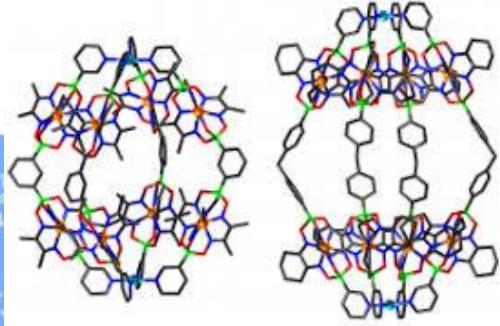




P BLOCK ELEMENTS

#BOUNCEBACK

GROUP 17 & 18



Sakshi Vora

IIT Roorkee

- 7+ years Teaching experience
- 10th, 12th CBSE State Topper
- KVPY fellow

BounceBack





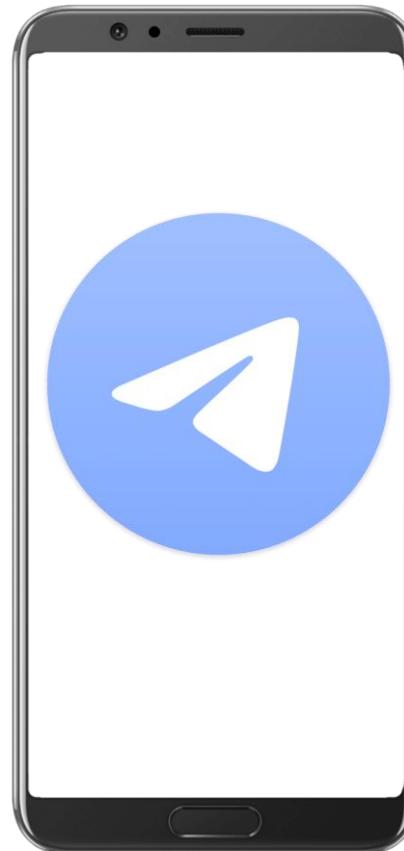
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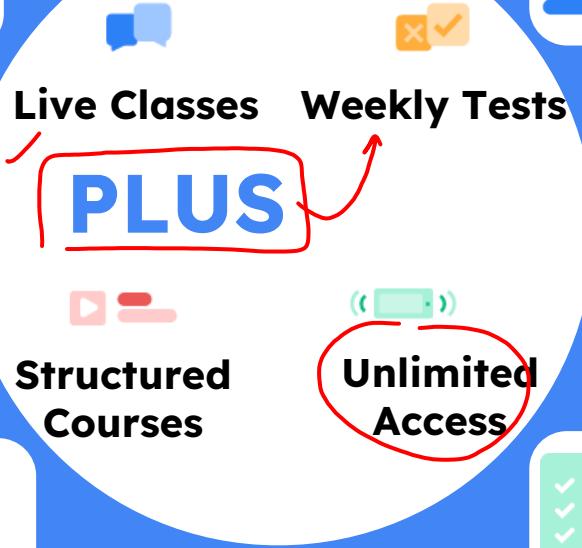
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Nov 13th | 8:00 PM

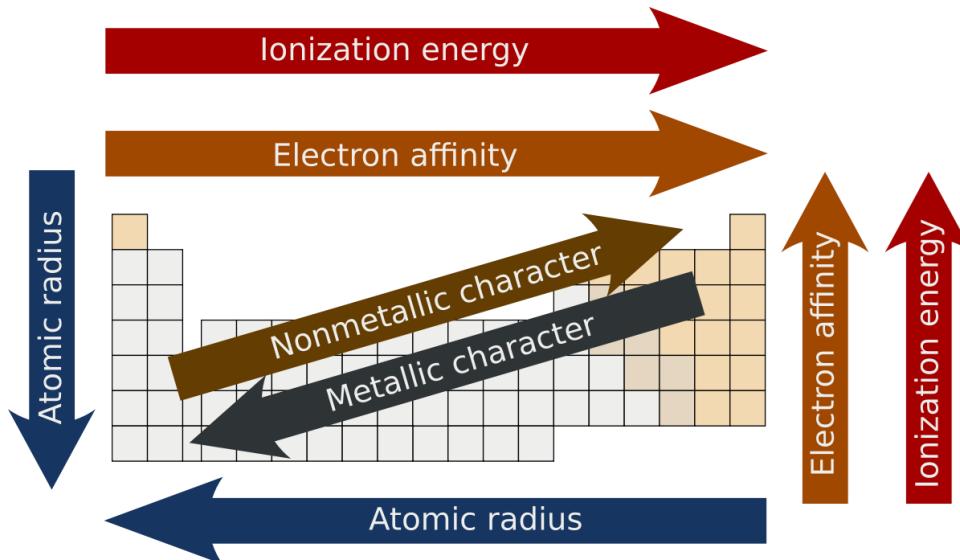
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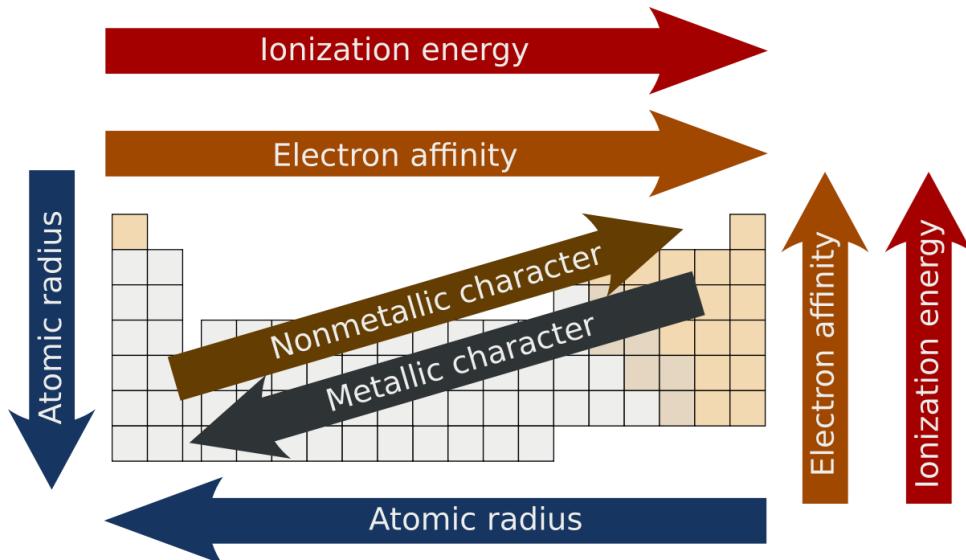


p block elements : group 17 & 18



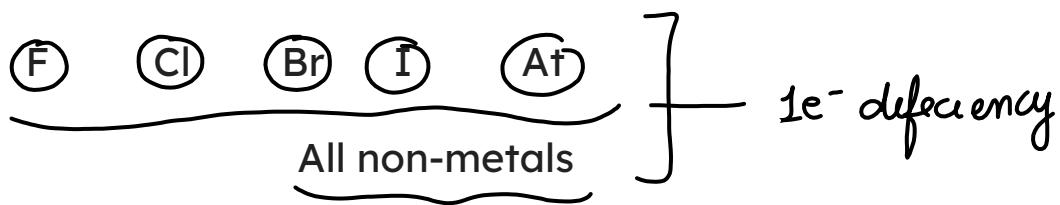


Group 17





Group - 17 Halogens



General electronic configuration : $\text{ns}^2 \text{np}^5 + 1\text{e}^- \rightarrow \text{ns}^2 \text{np}^6$

F

Cl

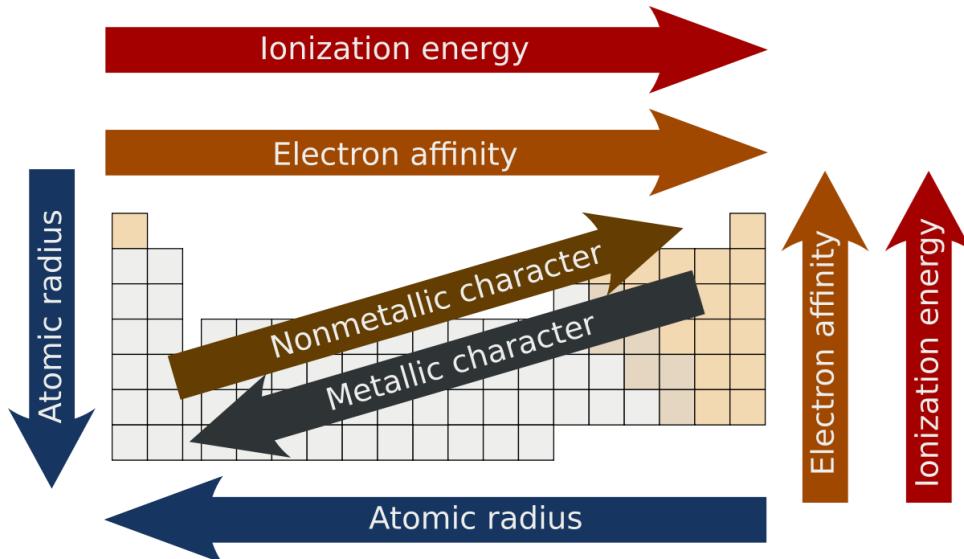
Br

I

At

(-1)

Variations in Group 17





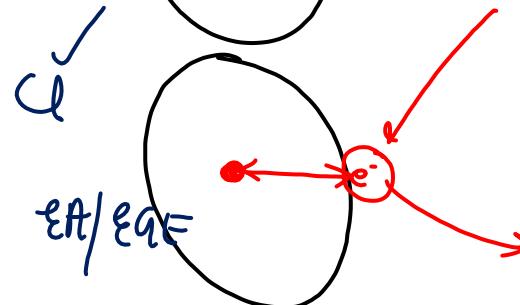
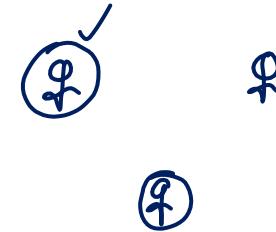
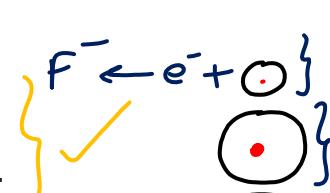
Variations in group - 17

✓ Atomic Radius : F < Cl < Br < I

✓ Ionization Energy : F > Cl > Br > I

✗ Electron Affinity : Cl > F > Br > I

Electronegativity : F > Cl > Br > I





Variations in group - 17



Bond energy : $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$

Bond length : $\text{F}_2 < \text{Cl}_2 < \text{Br}_2 < \text{I}_2$

M.Pt / BpT : $\text{F}_2 < \text{Cl}_2 < \text{Br}_2 < \text{I}_2$

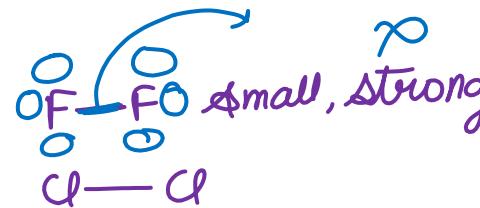
F_2 : Pale yellow gas

Cl_2 : dark yellow gas

Br_2 : Reddish brown liquid

I_2 : Violet Black solid

colour?

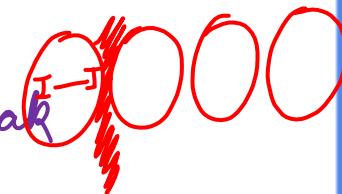


$\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$

oo o o o

ooooo

00000



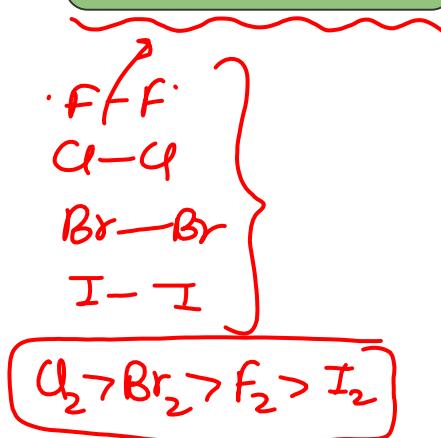


Arrange the following bonds according to their average bond energies in descending order: C - Cl, C - Br, C - F, C - I



- A. ~~C - F > C - Cl > C - Br > C - I~~
- B. C - Br > C - I > C - Cl > C - F
- C. C ~~I~~ ^{long} > C - Br > C - Cl > C - F
- D. C - Cl > C - Br > C - I > ~~C - F~~
- bond - small → strong*

Jan. 08, 2020 (II)





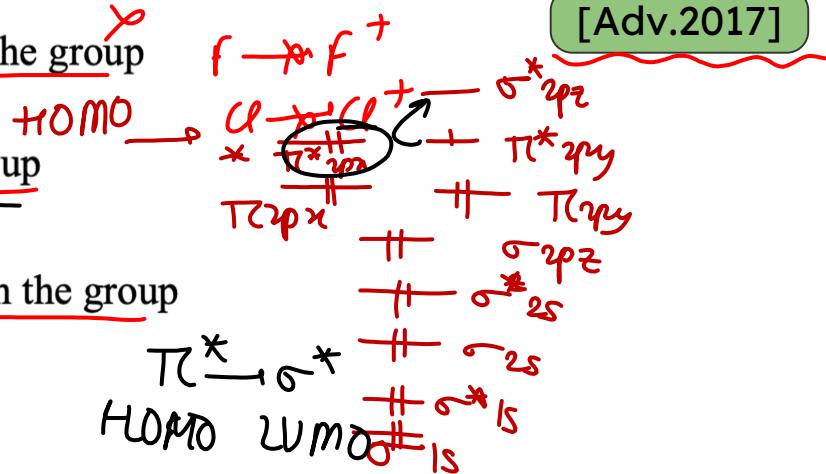
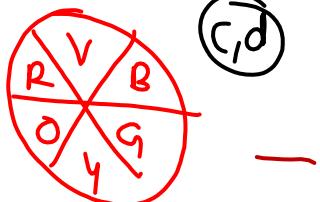
The colour of the X_2 molecules of group 17 elements changes gradually from yellow to violet down the group. This is due to

- A. The physical state of X_2 at room temperature changes from gas to solid down the group \times

- B. Decrease in ionization energy down the group \times

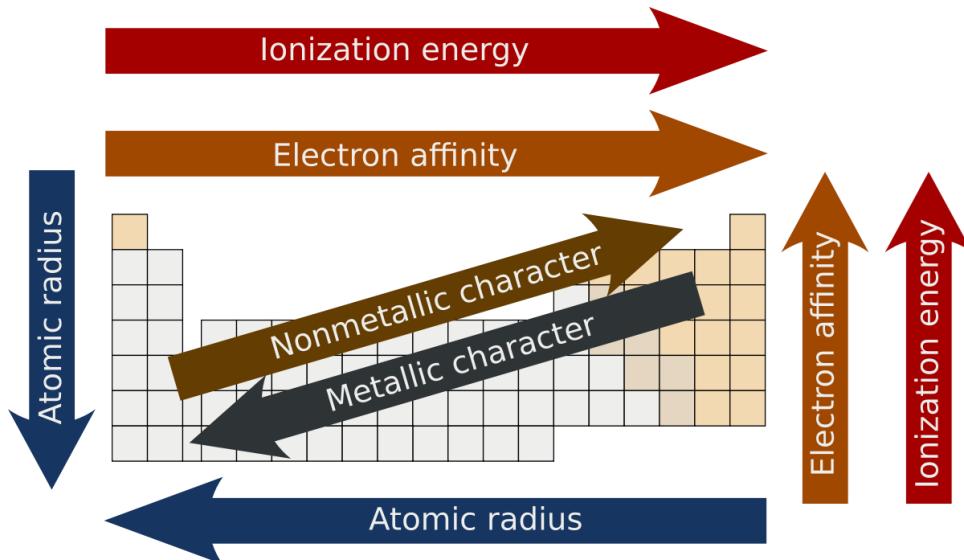
- C. Decrease in $\pi^* - \sigma^*$ gap down the group

- D. Decrease in HOMO-LUMO gap down the group \times





Anomalous behavior of F





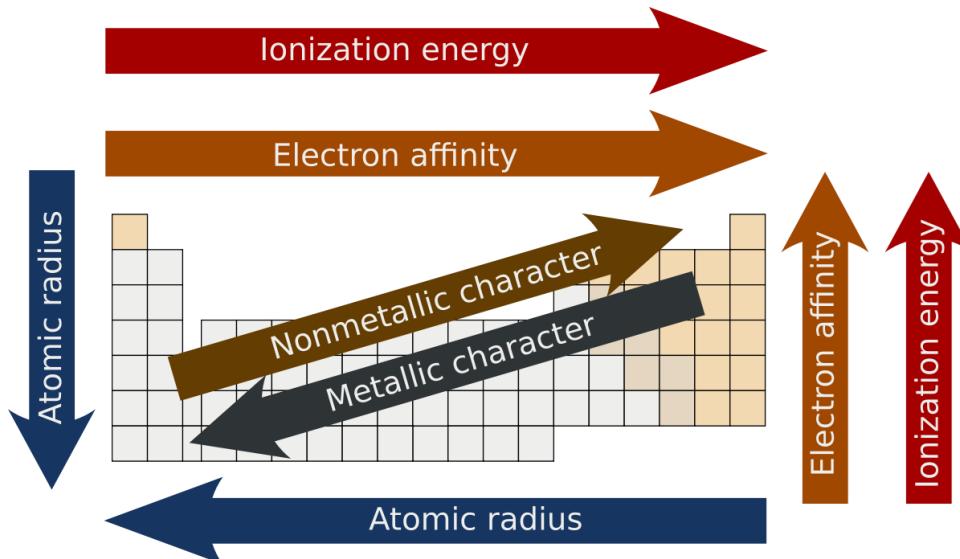
Anomalous Behavior of F



- Small size
- Highest electronegativity
- Low covalency $\text{H}-\text{F}$
- Low bond dissociation energy BDE $\text{F} \leftarrow \text{F}$
- Highest oxidising nature why?
- Absence of d orbitals

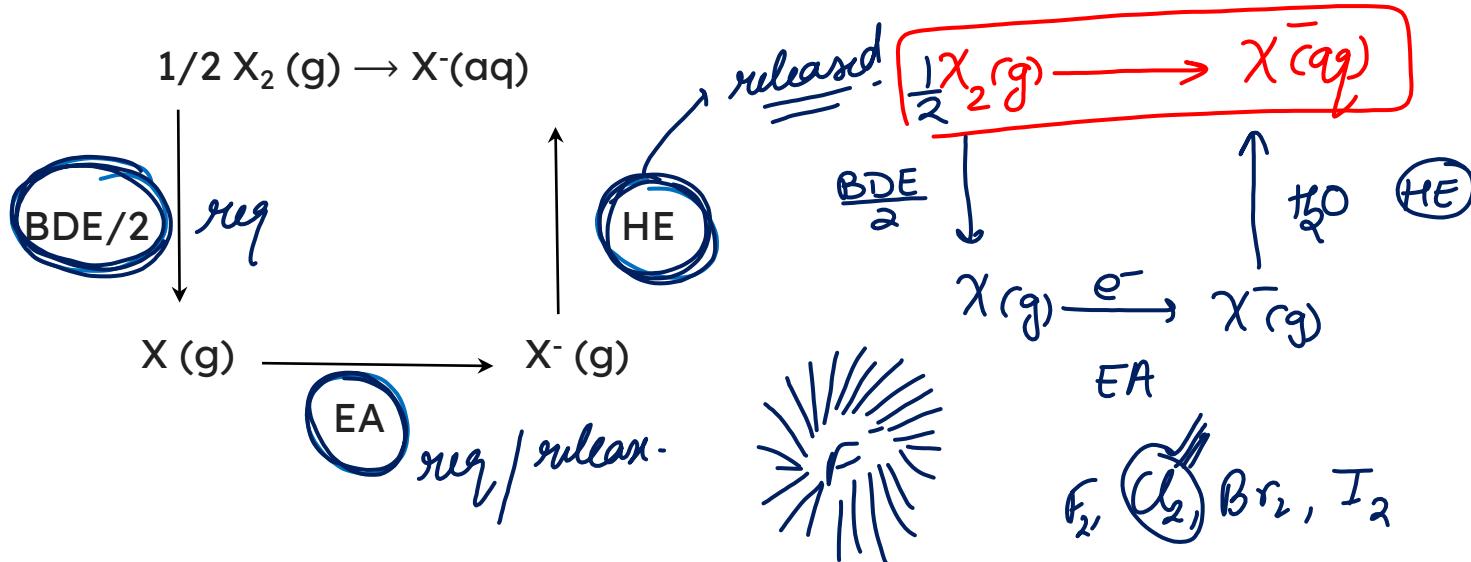
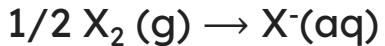


Oxidising nature





Oxidising & reducing nature of halogens —





Oxidising & Reducing Nature of Halogens



On comparing BDE, EA and HE

Oxidising nature - $F_2 > Cl_2 > Br_2 > I_2$

Reducing nature : $F^- < Cl^- < Br^- < I^-$

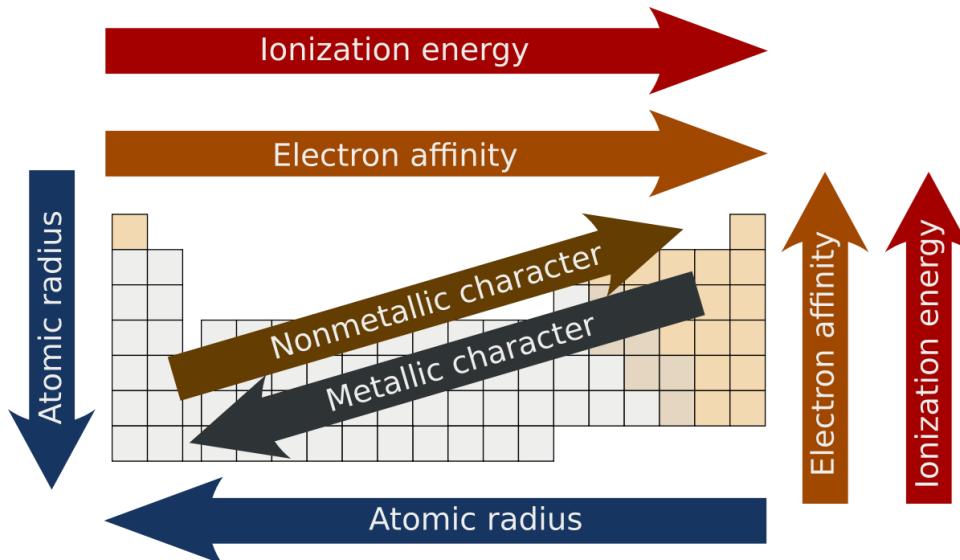
HE High

?

?

?

Reactivity towards hydrogen





Reactivity towards Hydrogen -



Reactivity : $F_2 > Cl_2 > Br_2 > I_2$

Reaction of fluorine can occur in dark

Reaction of iodine requires hv / catalyst



Reactivity towards Hydrogen -

$-\Delta H_f$



B length: $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$

Bond energy: $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$

Acidic nature: $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$

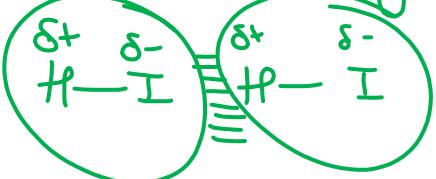
jpl

M.pt.: $\text{HI} > \text{HF} > \text{HBr} > \text{HCl}$

B.pt.: $\text{HF} > \text{HI} > \text{HBr} > \text{HCl}$



H_2 I weak
 H^+, I^-





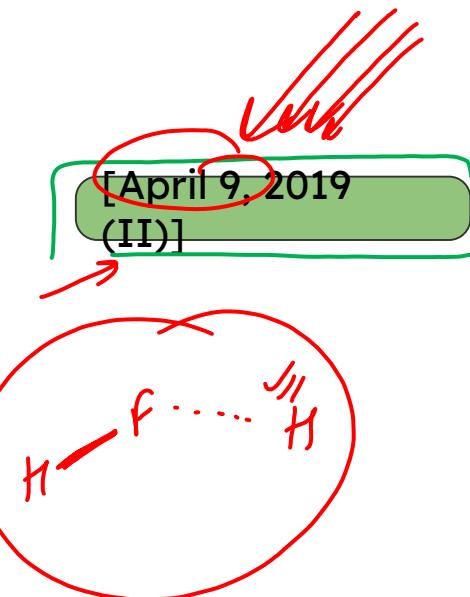
HF has highest boiling point among hydrogen halides, because it has:

A. strongest van der Waals' interactions ✗

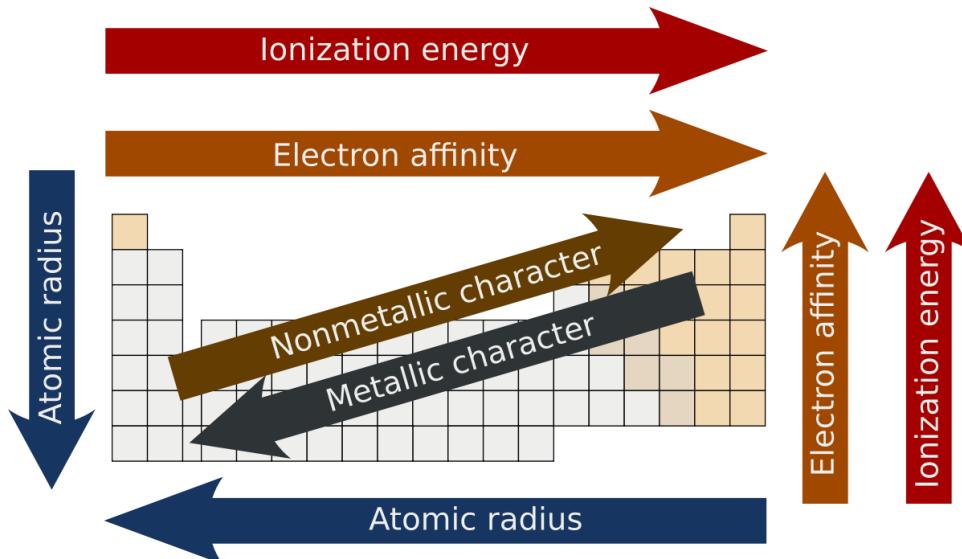
B. lowest ionic character ✗

~~strongest hydrogen bonding~~

D. lowest dissociation enthalpy



Reactivity towards Oxygen

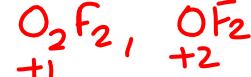




Reactivity towards Oxygen -



Most of the compounds are OA (fluorides of oxygen)



Cl, Br, I form oxides from +1 to +7

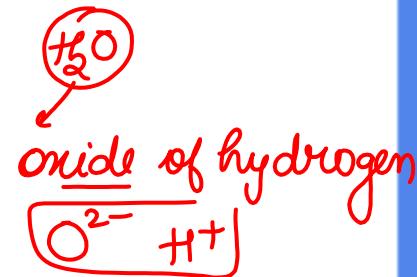
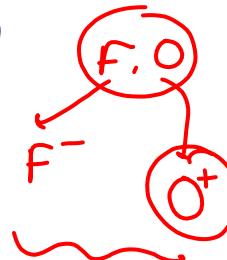
As +ve charge inc, stability of oxides inc

For a particular OS

Stability I > Cl > Br

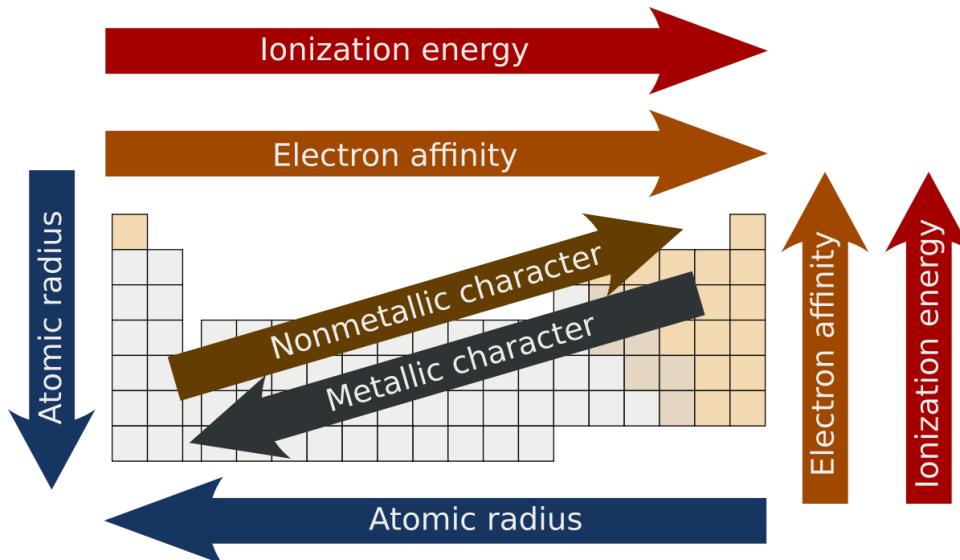


$$\begin{aligned} 2x + 2(-1) &= 0 \\ 2x &= 2 \\ x &= +1 \end{aligned}$$



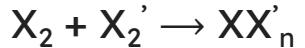


Interhalogen compounds





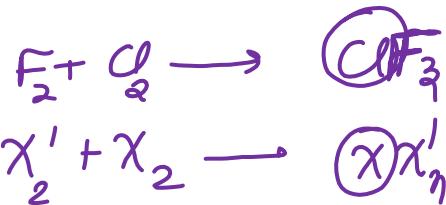
Reactivity towards Halogen -



Interhalogen compounds

$n = 1, 3, 5, 7$

eneg : $X < X'$



central atom:

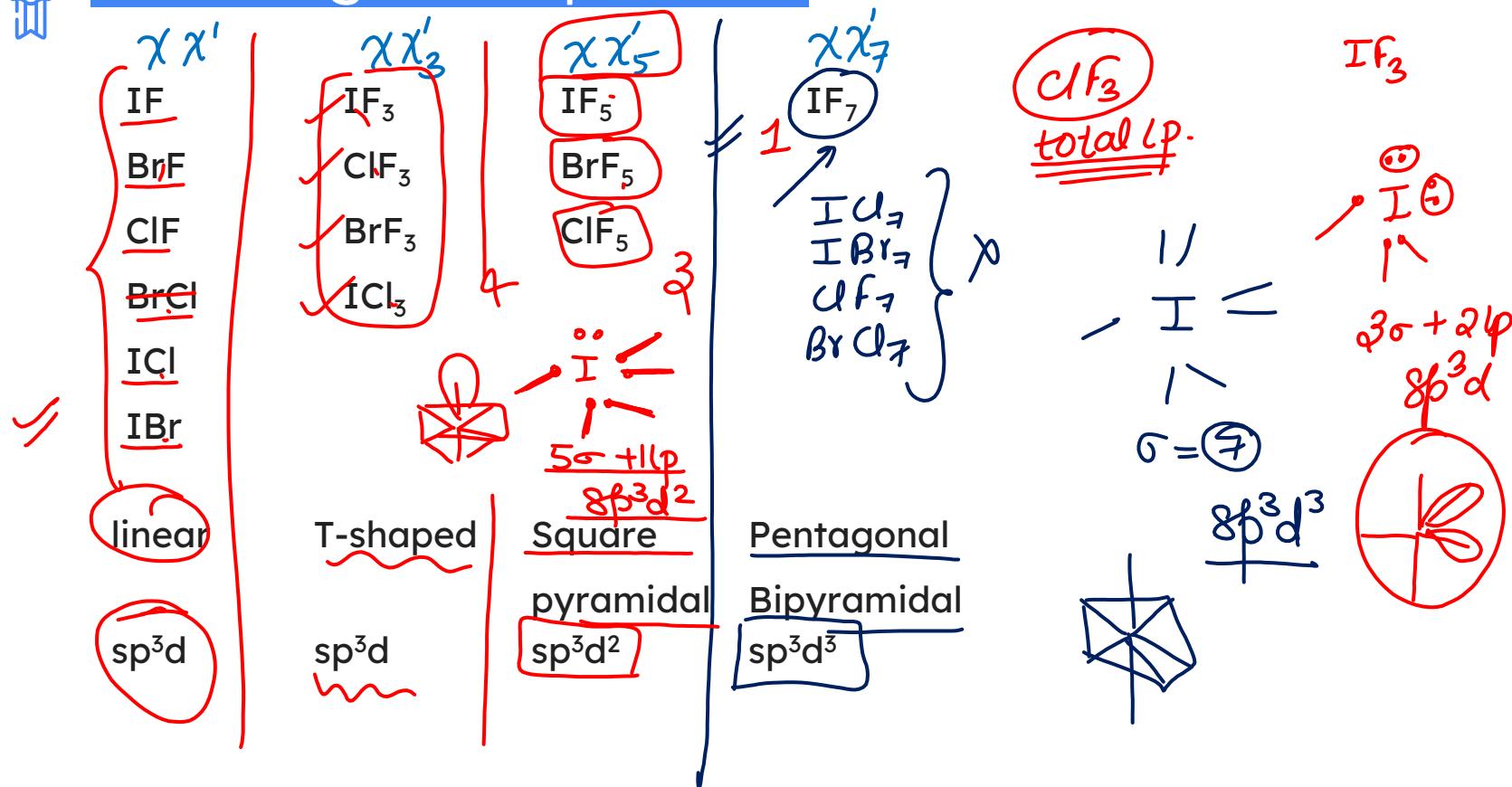
big in size
covalency more
len e nup.

side atom:

small
eneg. high
covalency (len)

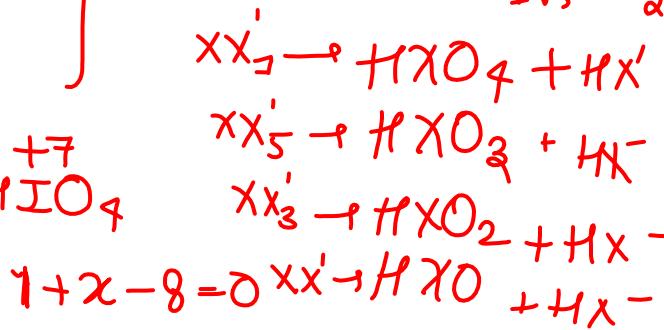
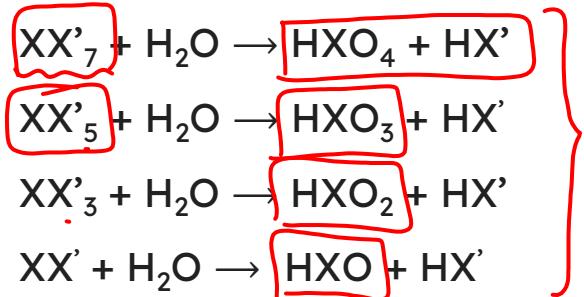


Interhalogen compounds -



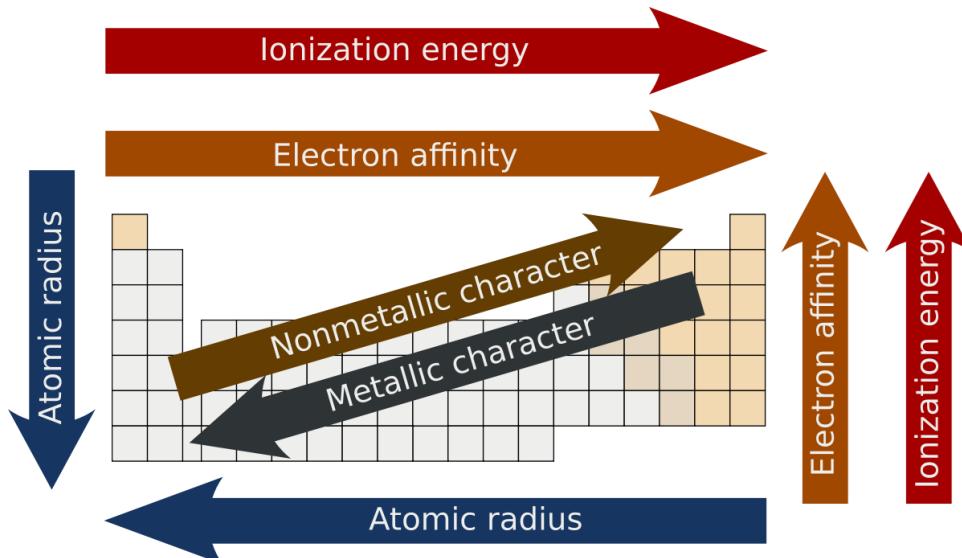


Hydrolysis of interhalogen compounds -





Reactivity order



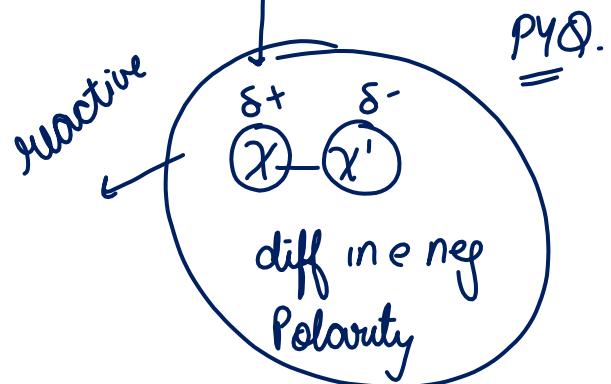


Reactivity order-



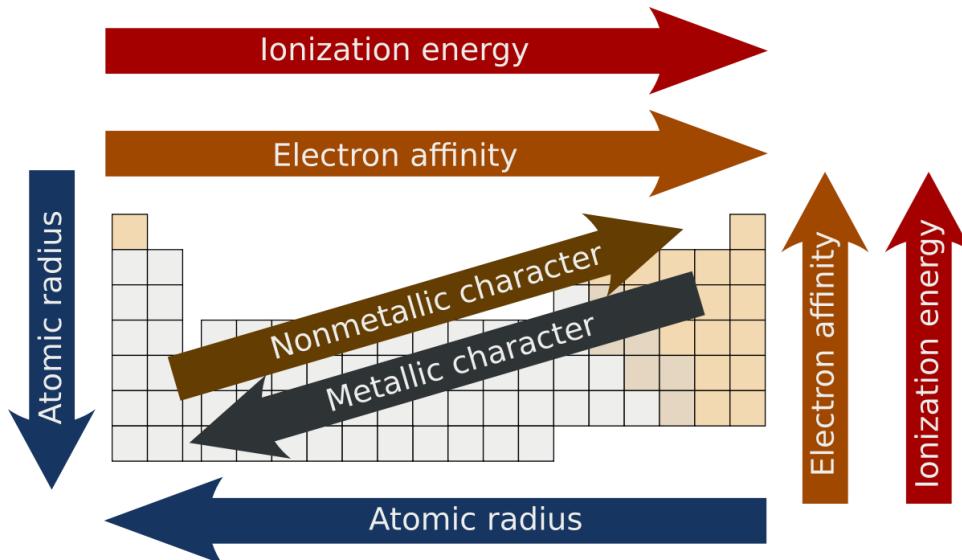
$F_2 >$ Interhalogen compounds $> Cl_2 > Br_2 > I_2$

chemical Bonding



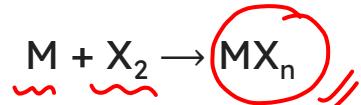


Reactivity towards metals

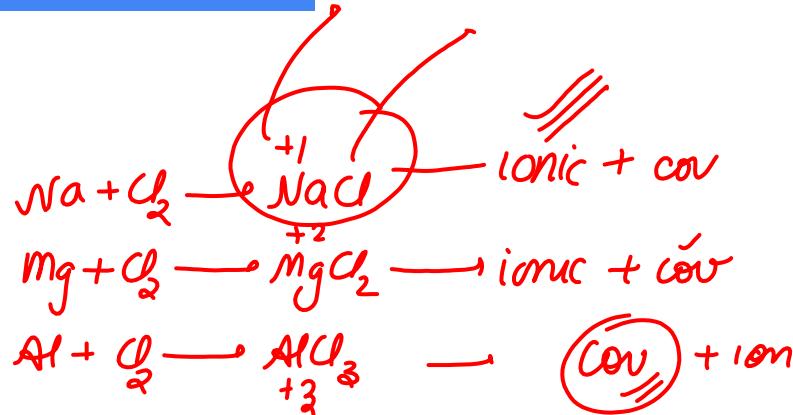




Reactivity towards metals -



As +ve charge ↑
Covalent nature ↑
Ionic nature ↓

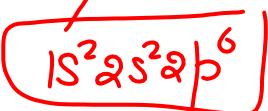




Aqueous solution of which salt will not contain ions with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6$?



B.



C.

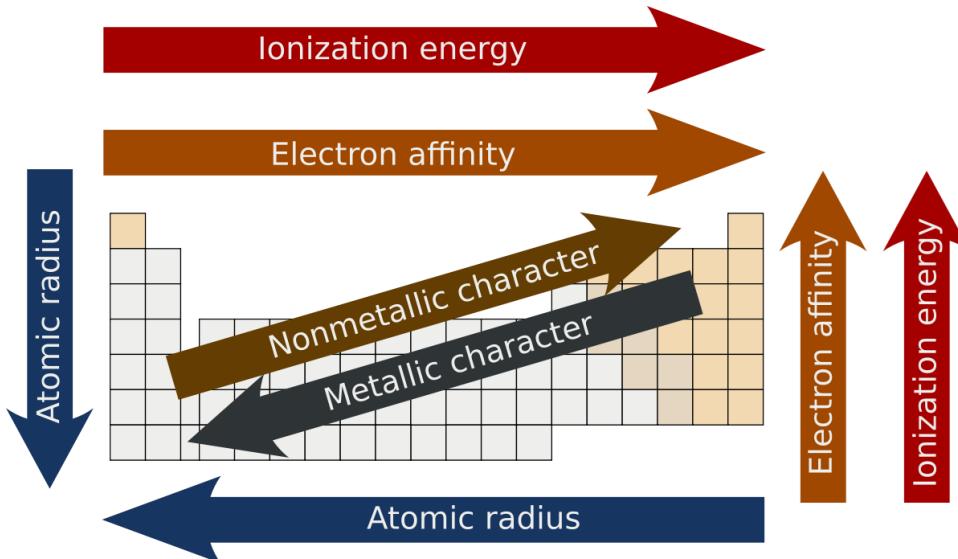


D.



[April 10, 2016]

Preparation of Halogens





Preparation of halogens -



a. F_2

Electrolysis of KHF_2 : Moisson process



b. Cl_2

Deacon's process

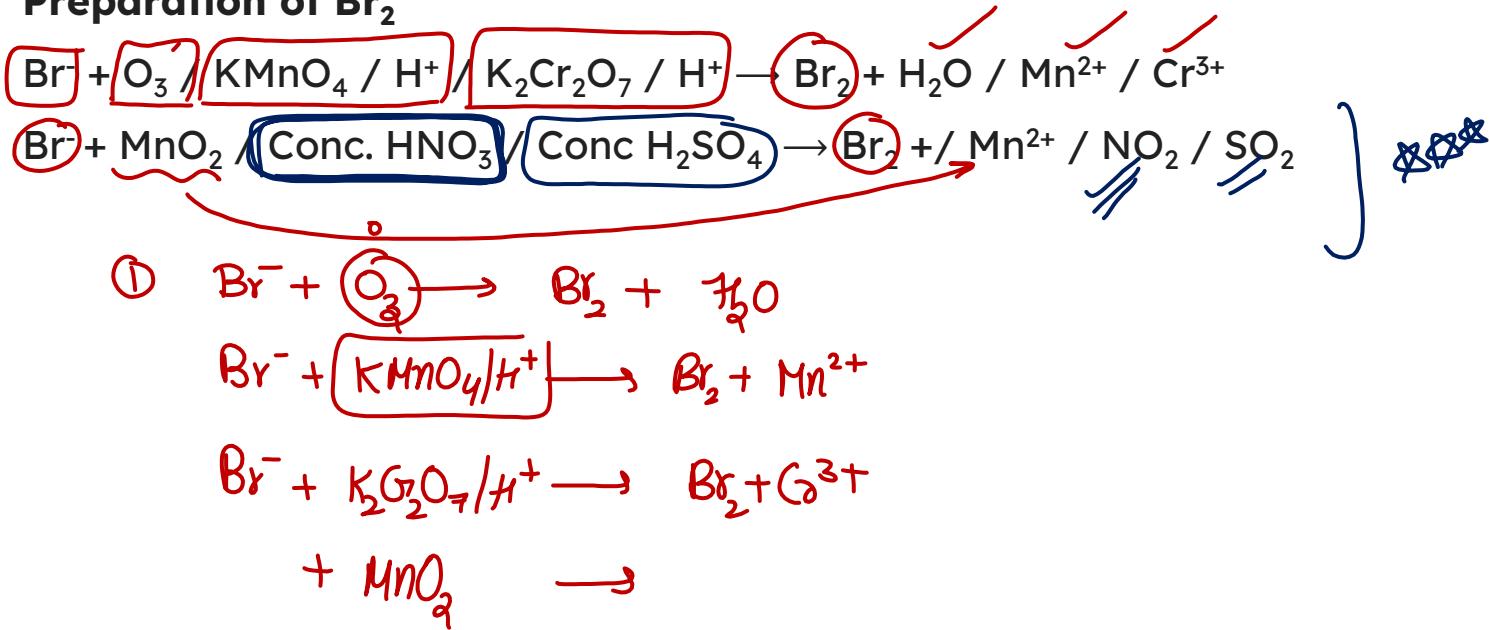




Preparation of halogens -



Preparation of Br_2

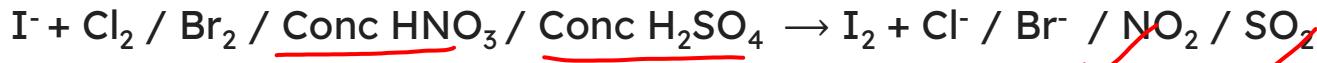




Preparation of halogens -



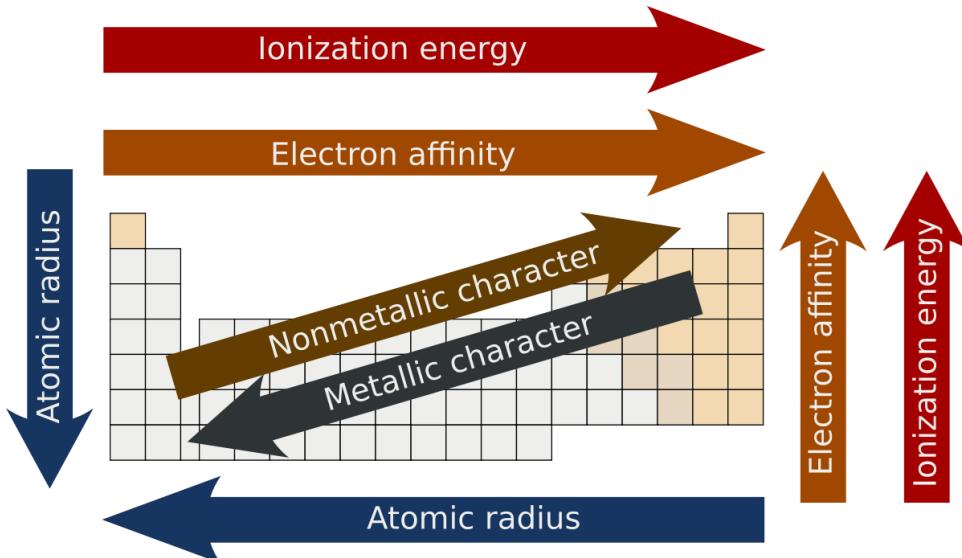
Preparation of I₂



}

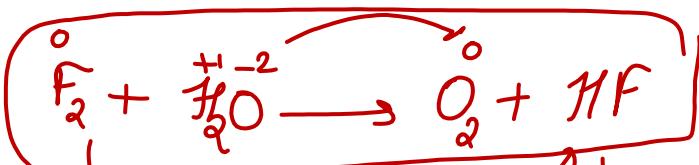
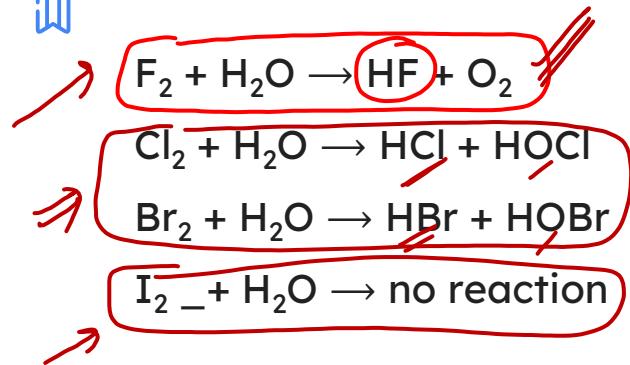


Reaction with water



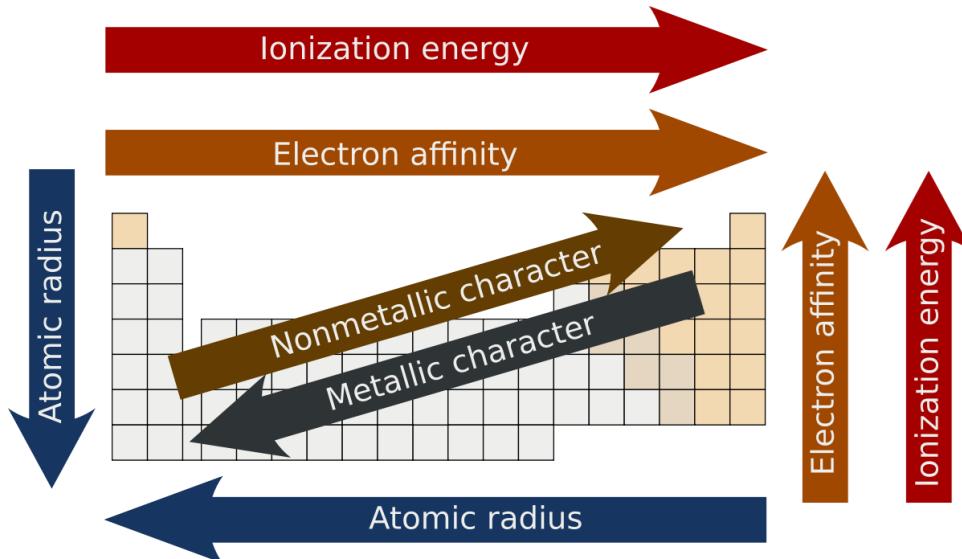


Reaction of Halogens with water -



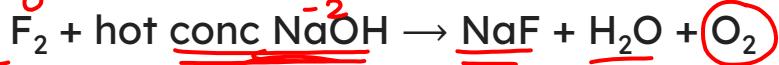
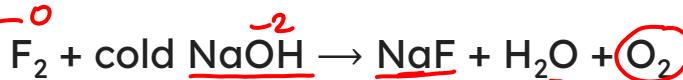


Reaction with NaOH

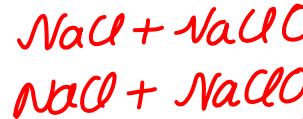




Reaction with NaOH -



$$I + x - 2 = 0 \\ x = -1 = -O \\ x = +1$$



$$I + x - 6 = 0$$

NaF, NaO, O₂

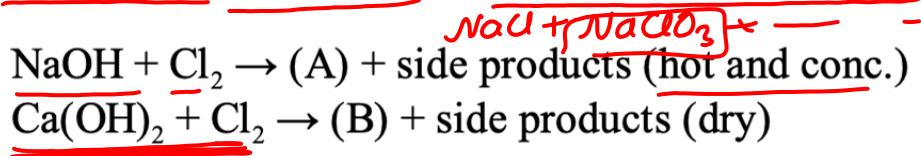
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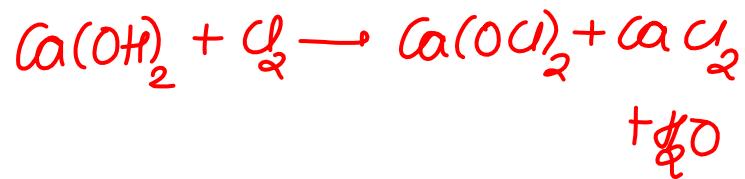
In the following reactions, products (A) and (B), respectively, are:



A. NaClO₃, and Ca(ClO)₂

Jan. 07, 2020 (II)

B. NaClO₃ and Ca(ClO₃)₂



C. NaOCl and Ca(ClO)₂

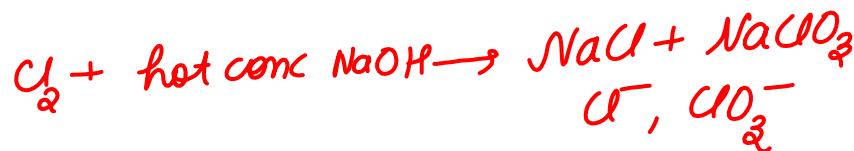
D. NaOCl and Ca(ClO₃)₂





Chlorine on reaction with hot and concentrated sodium hydroxide gives :

- A. Cl⁻ and ClO₃⁻
- B. Cl⁻ and ClO⁻
- C. ClO₃⁻ and ClO₂⁻
- D. Cl⁻ and ClO₂⁻

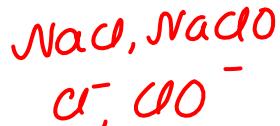


[Jan. 12, 2019 (II)]



The products obtained when chlorine gas reacts with cold and dilute aqueous NaOH are :

- A. ClO^- and ClO_3^-



- B. ClO_2 and ClO_3^-

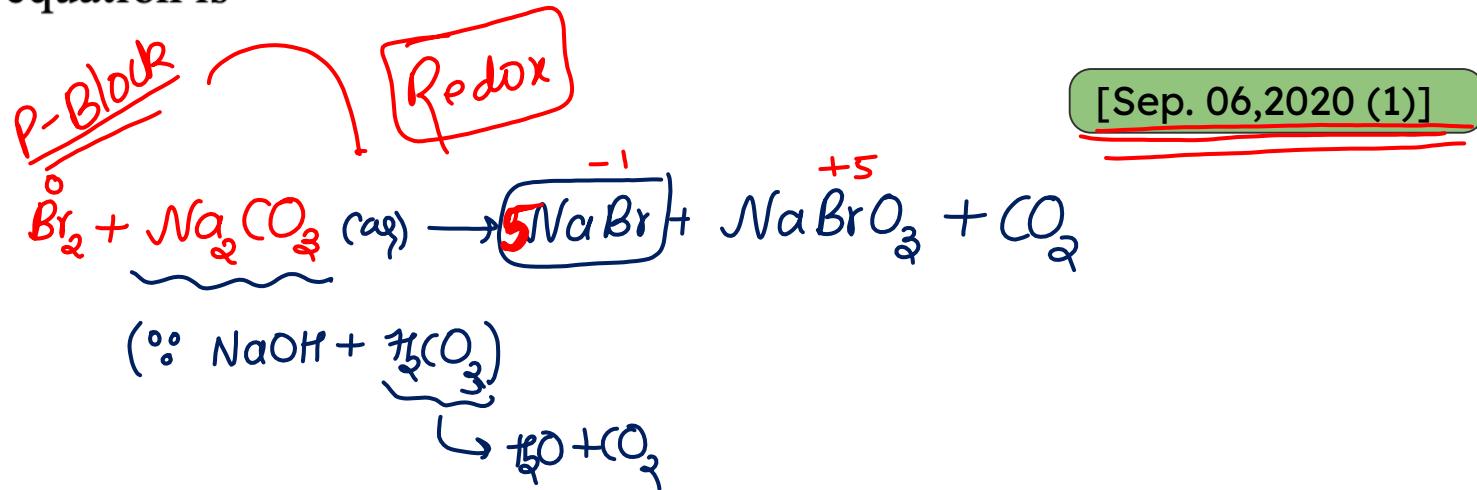
- C. Cl^- and ClO^-

- D. Cl^- and ClO_2

[Main 2017]

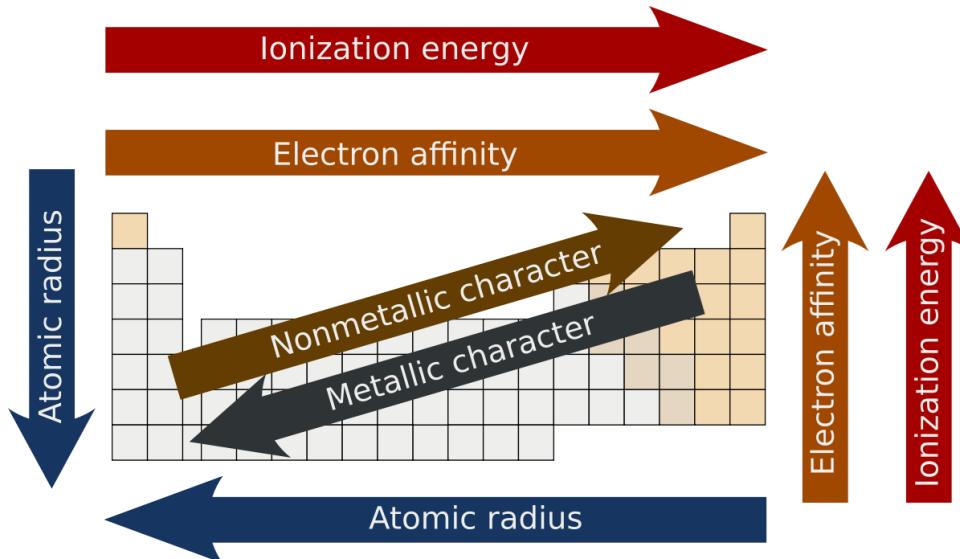


Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide and sodium bromate with evolution of CO_2 gas. The number of sodium bromide molecules involved in the balanced chemical equation is





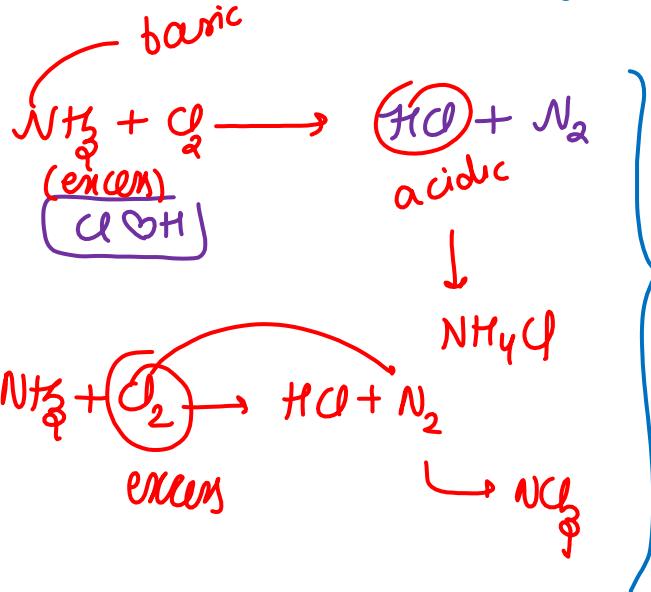
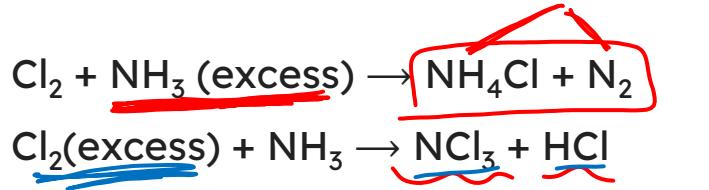
Reaction with Ammonia





Reaction with NH_3 -

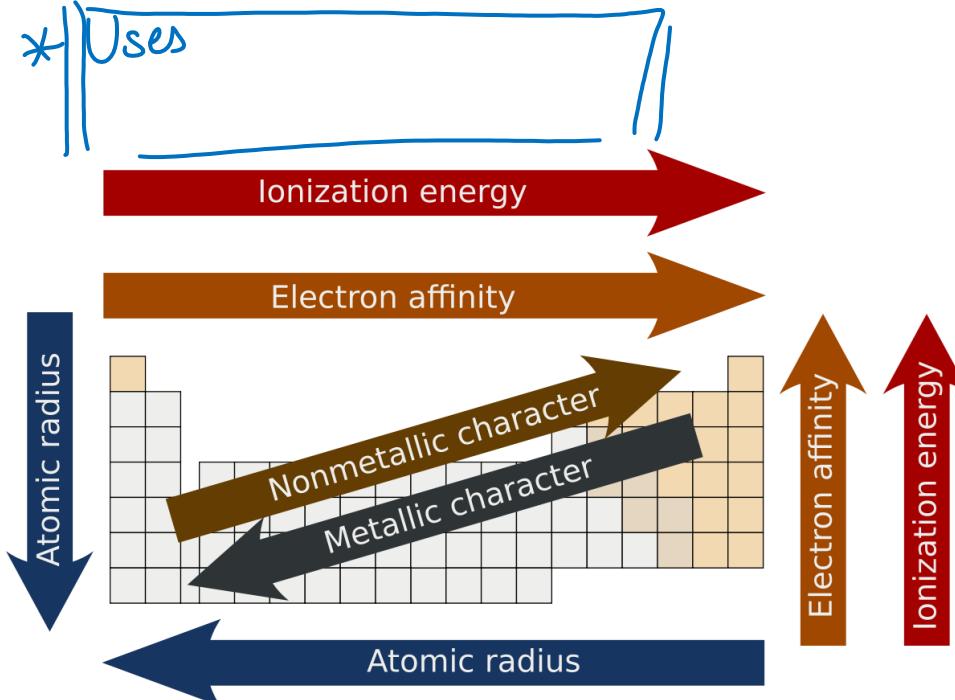
already
q/p/s
Ques.





Important points

* || Uses





Important Note

Poisonous Gases

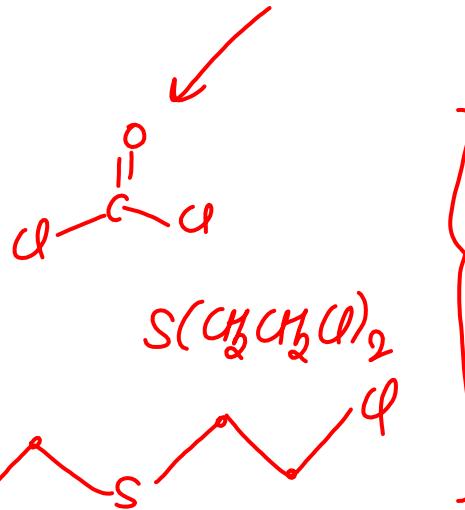
Phosgene



Tear gas

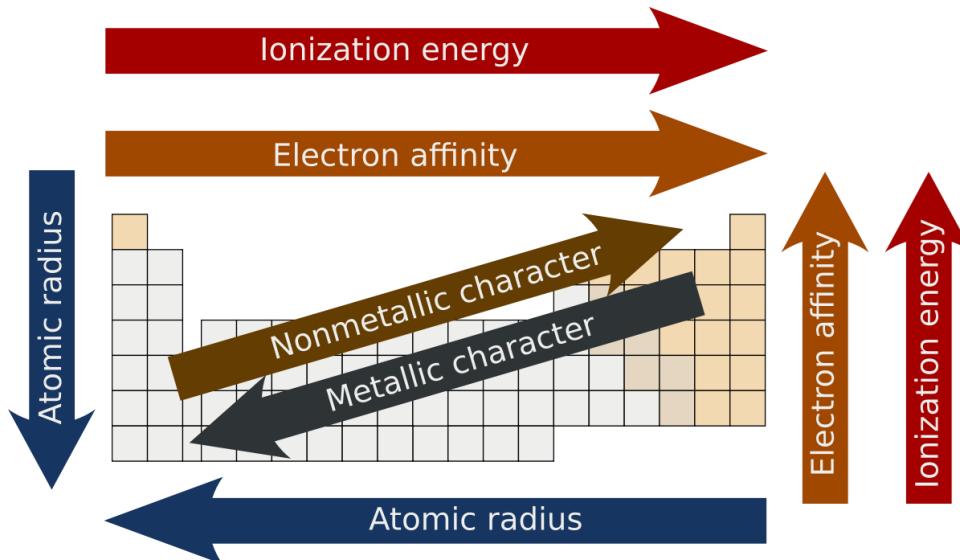


Mustard gas



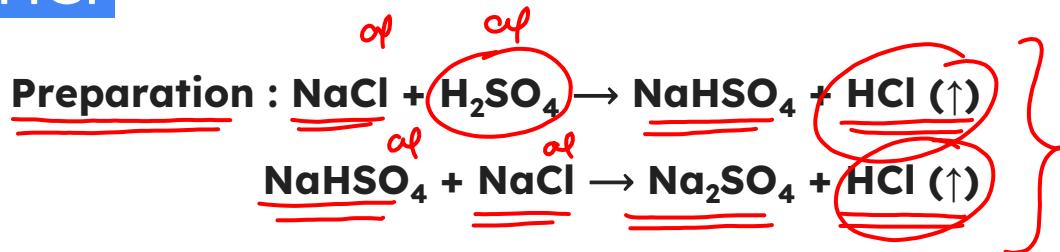


Hydrochloric acid

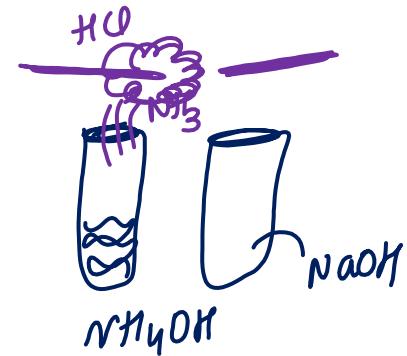
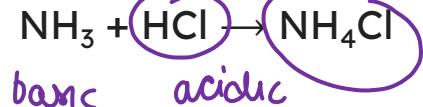




HCl



- HCl can be dried by conc. H_2SO_4
- HCl is colourless and has pungent smell and acidic





A colorless aqueous solution contains nitrates of two metals, **X** and **Y**. When it was added to an aqueous solution of NaCl, a white precipitate was formed. This precipitate was found to be partly soluble in hot water to give a residue **P** and a solution **Q**. The residue **P** was soluble in aq. NH₃, and also in excess sodium thiosulfate. The hot solution **Q** gave a yellow precipitate with KI. The metals **X** and **Y**, respectively, are

C
S,
Ge
Sn
(W)
x2

- A. Ag and Pb
- B. Ag and Cd
- C. Cd and Pb
- D. Cd and Zn

colorless ag solution

X, Y nitrates flg

$\downarrow \text{NaCl (aq)}$



PbI_2

$\downarrow \text{KI}$

$\downarrow \text{water hot}$

$\text{Q} + \text{P (residue)}$

$\text{BaCO}_3(\text{aq})$

\rightarrow

[Adv.
2020]

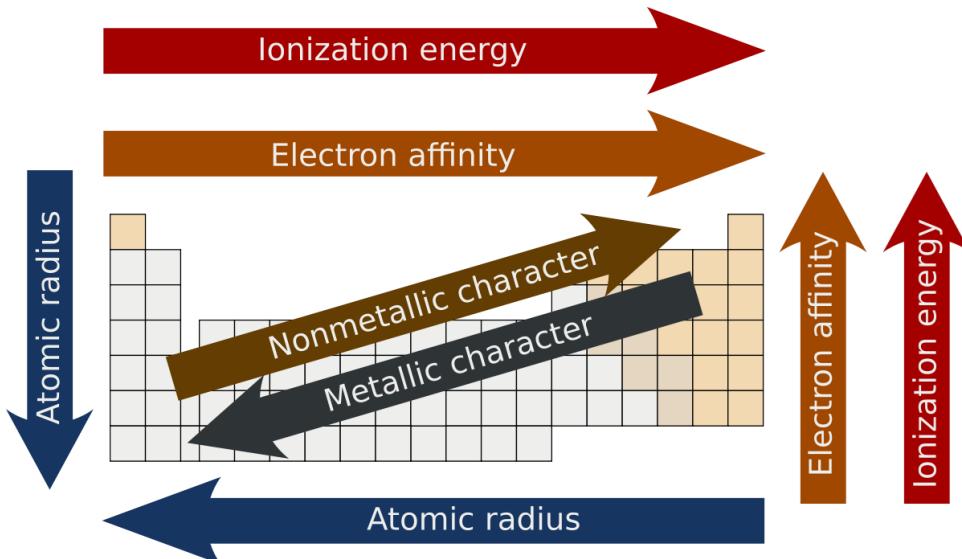
aq NH_3

$\text{AgCl} + \text{NH}_3$

$[\text{Ag}(\text{NH}_3)_2]^+$



Aqua Regia

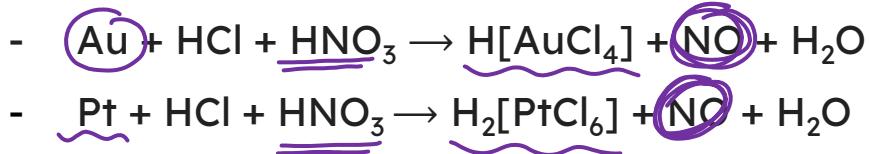




Aqua Regia

st OA
Conc HCl : Conc. HNO₃
3:1 3 . 1

- Very strong oxidising agent



**
group 15



Oxyacids of Halogens

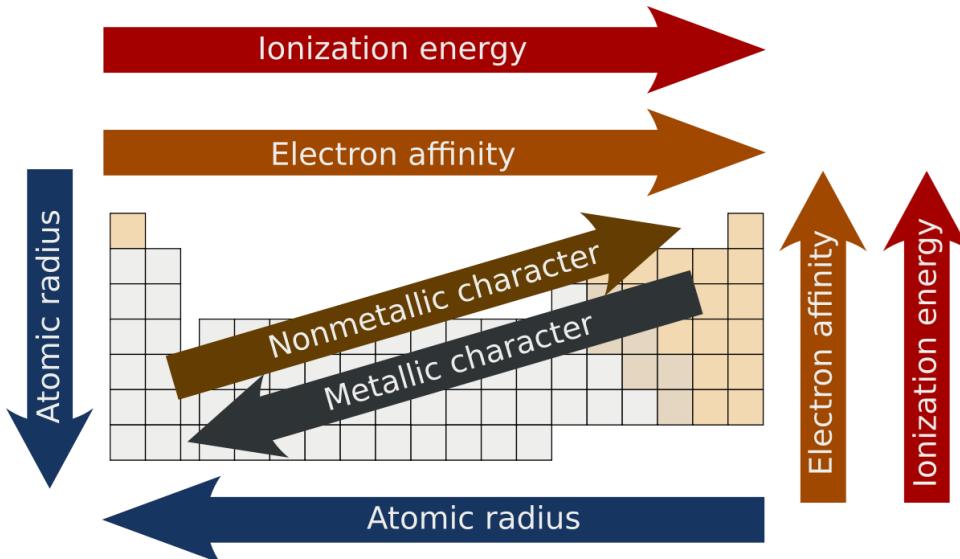
F

Halic (I) acid (Hypohalous acid)	HOF (Hypofluorous acid)	HOCl (Hypochlorous acid)	HOBr (Hypobromous acid)	HOI (Hypoiodous acid)
Halic (III) acid (Halous acid)	HFO₂	HOClO (chlorous acid)	HOBrO₂	HOIO₂
Halic (V) acid (Halic acid)	HFO₃	HOClO ₂ (chloric acid)	HOBrO ₂ (bromic acid)	HOIO ₂ (iodic acid)
Halic (VII) acid (Perhalic acid)	HFO₄	HOClO ₃ (perchloric acid)	HOBrO ₃ (perbromic acid)	HOIO₃ HOI₄



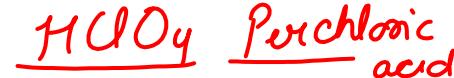


Oxyacids of Halogens





Oxyacids of Halogens



max +2 peric

max IC

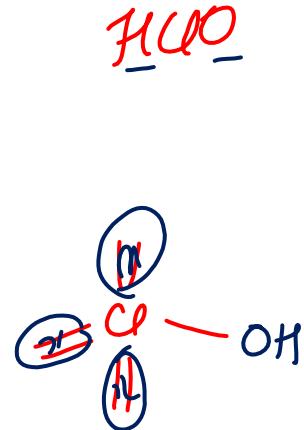
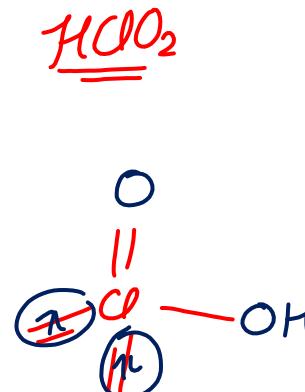
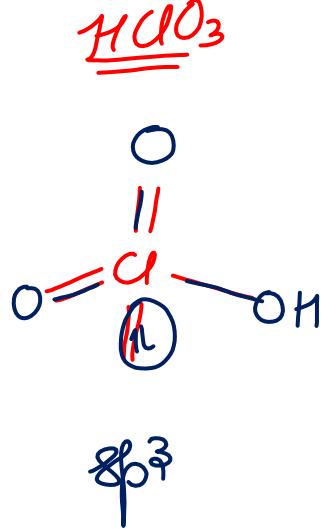
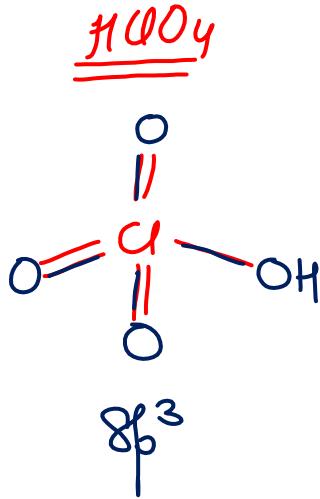
max-2 ous

ous-2 hypous

15 / 16



Oxyacids of Halogens

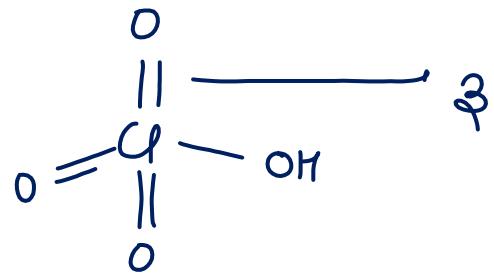




The number of Cl = O bonds in perchloric acid is,

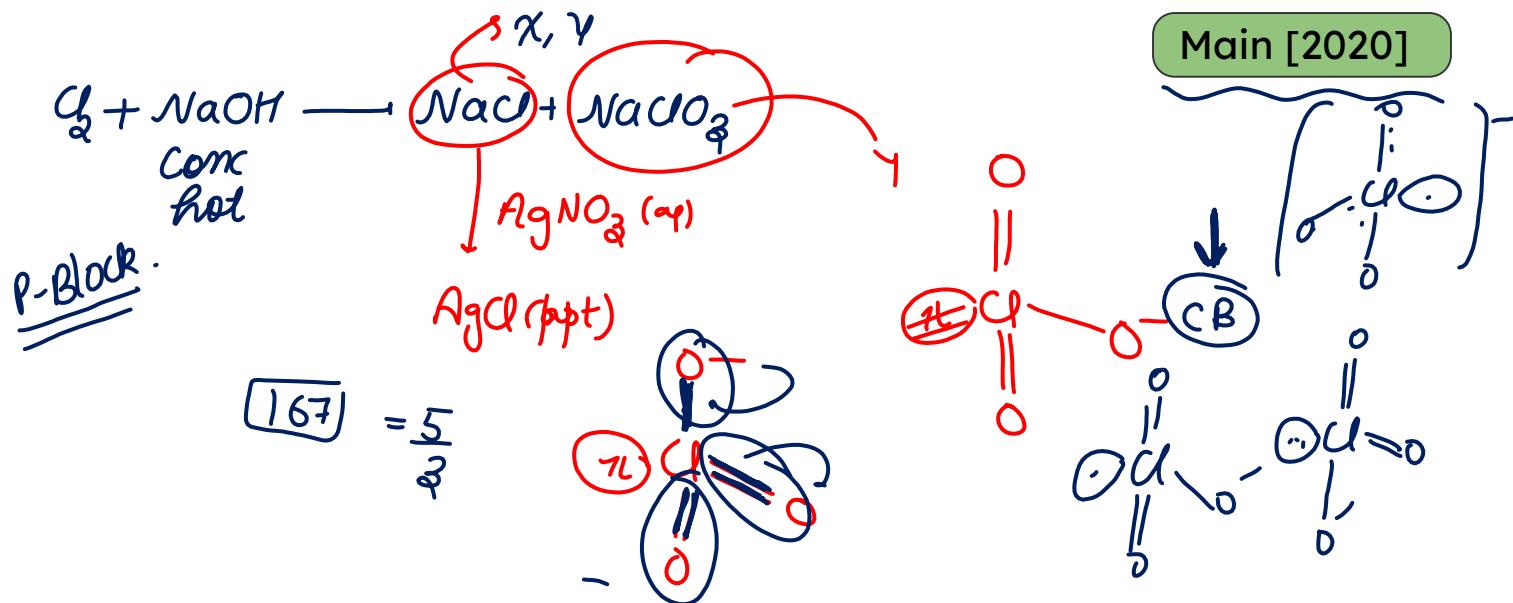


[Main. 2020]





Chlorine reacts with hot and concentrated NaOH and produces compounds (X) and (Y). Compound (X) gives white precipitate with silver nitrate solution. The average bond order between Cl and O atoms in (Y) is _____.





The correct statement(s) about the oxoacids, HClO₄ and HClO, is
(are)

abd

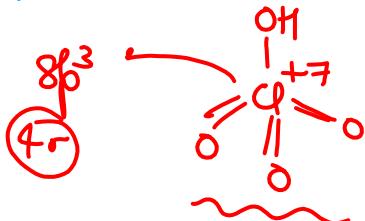
[Adv.2017]

~~A.~~ The central atom in both HClO₄ and HClO is *sp*³ hybridized

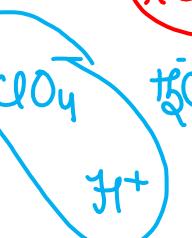
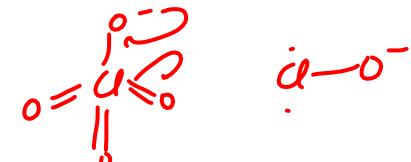
~~B.~~ HClO₄ is more acidic than HClO because of the resonance stabilization of its anion

C. HClO₄ is formed in the reaction between Cl₂ and H₂O

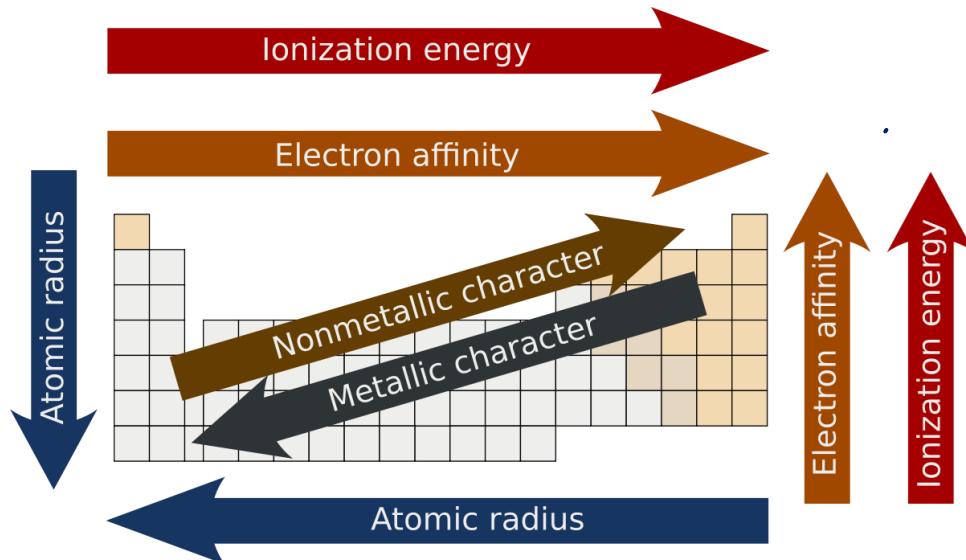
~~D.~~ The conjugate base of HClO₄ is weaker base than H₂O



$$1\sigma + 3lp = 8\delta^2$$

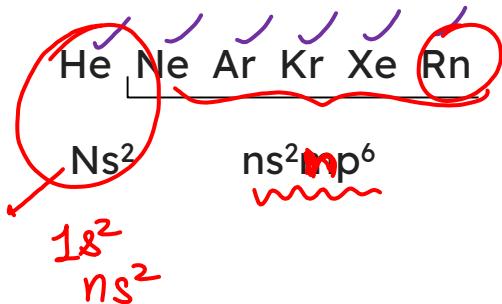


Group 18





Group 18



- All are **non metals**
- Rn is radioactive
- Size : He < Ne < Ar < Kr < Xe *Vanderwaal Radius.*
- Ionization energy : He > Ne > Ar > Kr > Xe
- Electron affinity : He < Ne < Ar < Kr < Xe

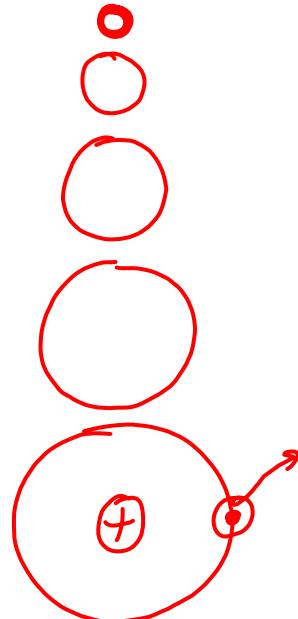
↓

Radon

→ Radium

Rn ✓

Ra ↗





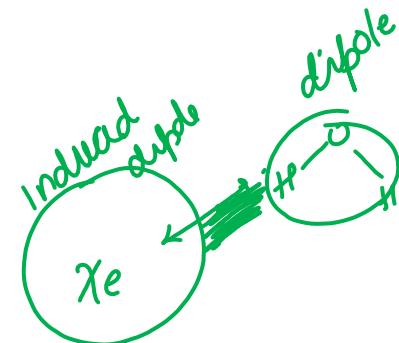
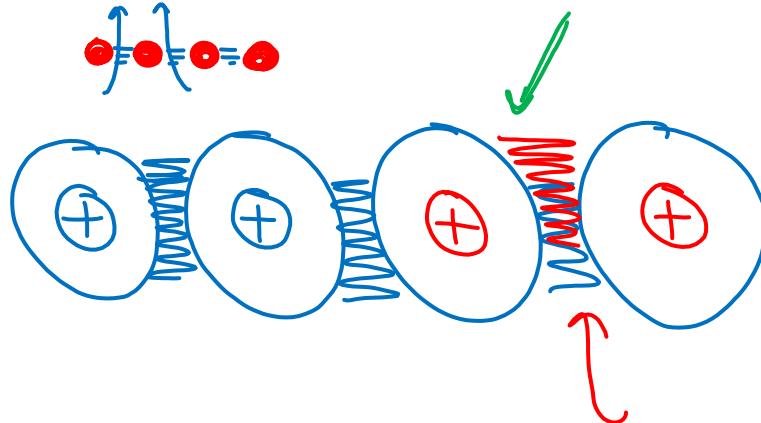
Group 18

✓ **Volatile nature**: $\text{He} > \text{Ne} > \text{Ar} > \text{Kr} > \text{Xe}$

✓ **Bpt / Mpt**: $\text{He} < \text{Ne} < \text{Ar} < \text{Kr} < \text{Xe}$

- **Ease of liquefaction**: $\text{He} < \text{Ne} < \text{Ar} < \text{Kr} < \text{Xe}$

- **Solubility in water**: $\text{He} < \text{Ne} < \text{Ar} < \text{Kr} < \text{Xe}$





The ~~noble~~ gas that does NOT occur in the atmosphere is :

A.

He



B.

Kr



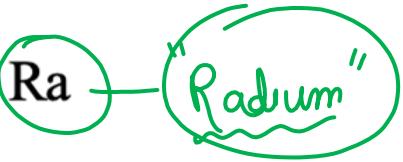
C.

Ne



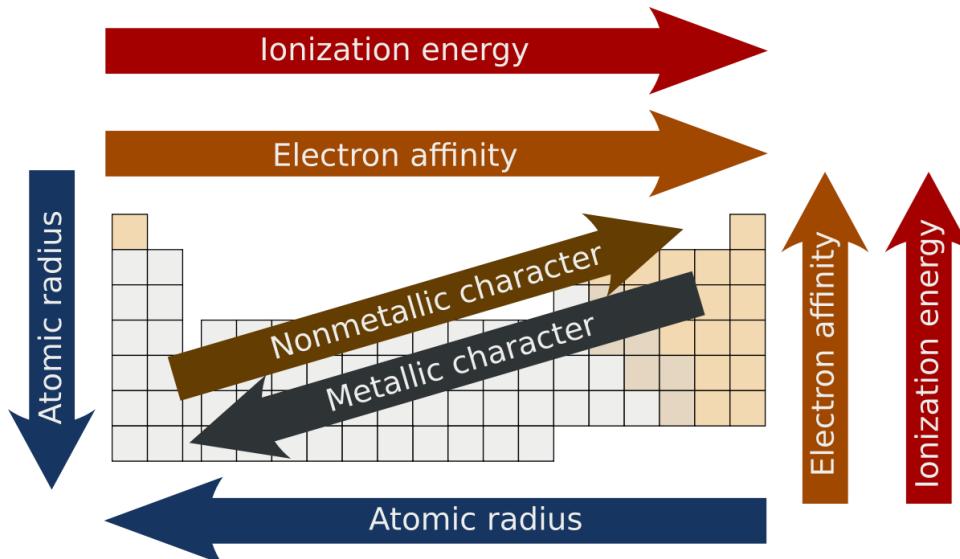
D.

Ra



[April 10, 2019 (II)]

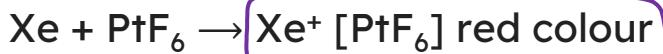
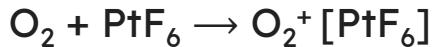
Chemical Reactions of Group 18



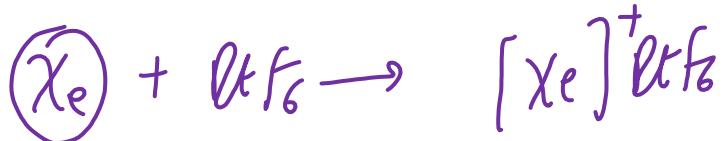


Chemical properties

" Neil Bartlett "

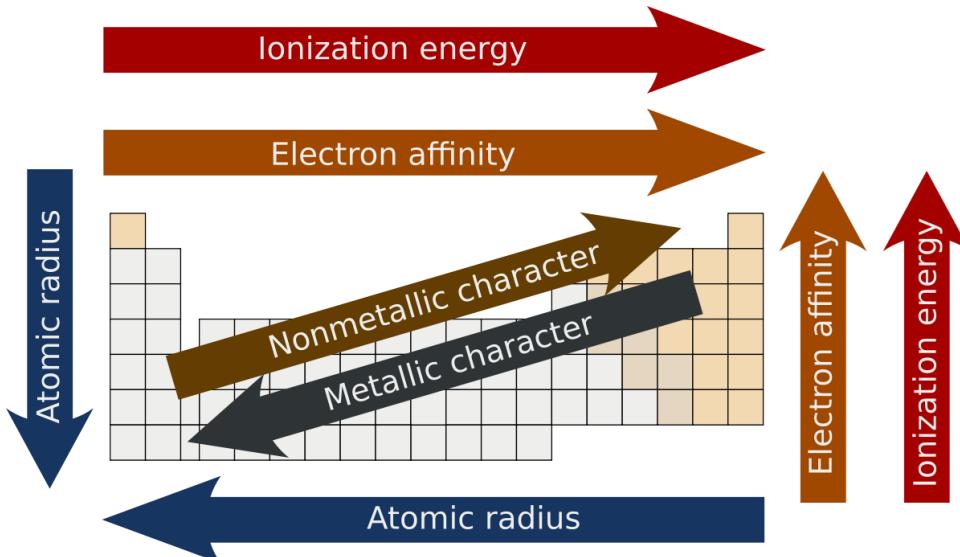


He
Ne
Ar
Kr
Xe





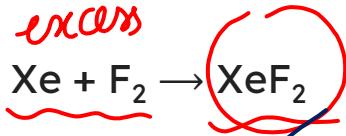
Fluorides of Xenon



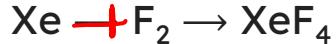


Xenon Fluorides

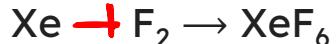
excess



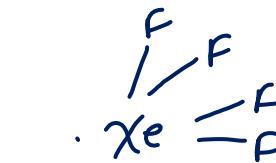
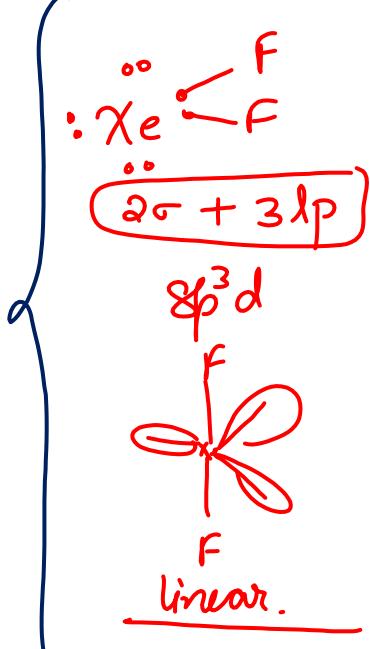
2 : 1



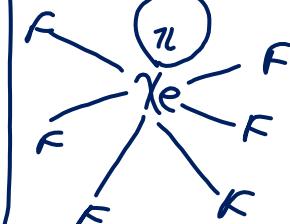
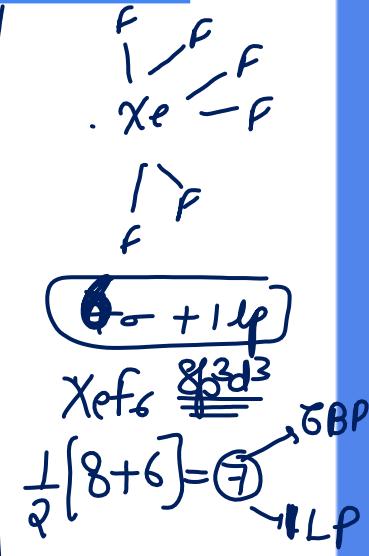
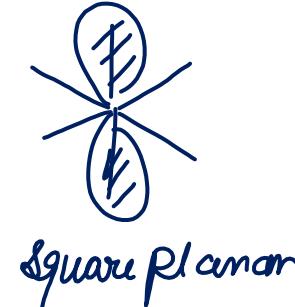
1 : 5



1 : 20

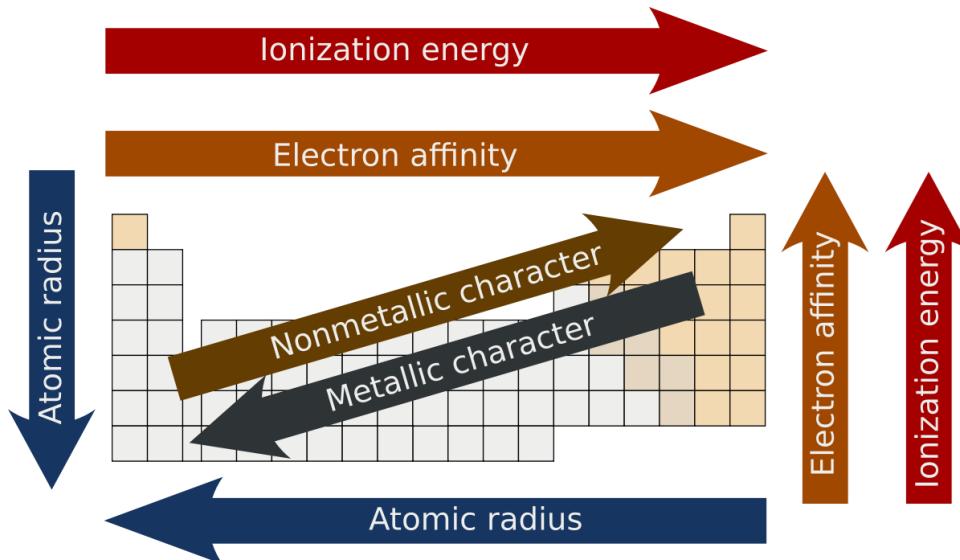


8p³d²



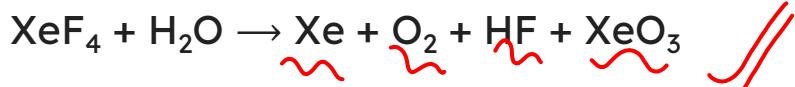
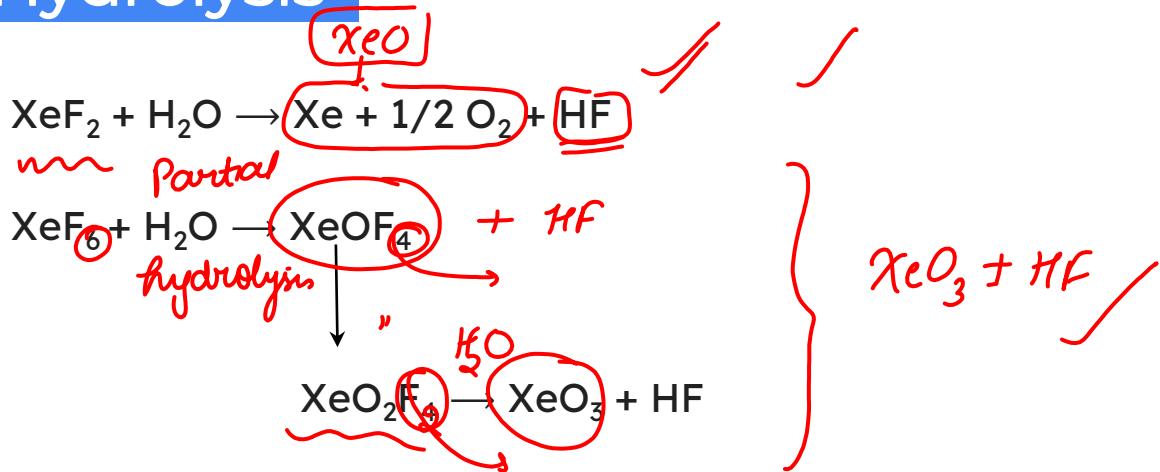


Hydrolysis of Xe Fluorides





Hydrolysis

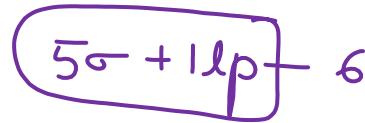
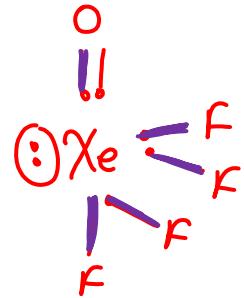




The type of hybridisation and number of lone pair(s) of electrons of Xe in XeOF_4 , respectively, are:

- A. ~~sp^3d^2 and 1~~
- B. sp^3d and 2
- C. sp^3d^2 and 2
- D. sp^3d and 1

[Jan 10, 2019 (I)]

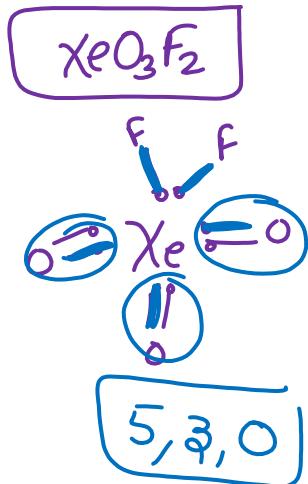




In XeO_3F_2 , the number of bond pair(s), π -bond(s) and lone pair(s) on Xe atom respectively are:



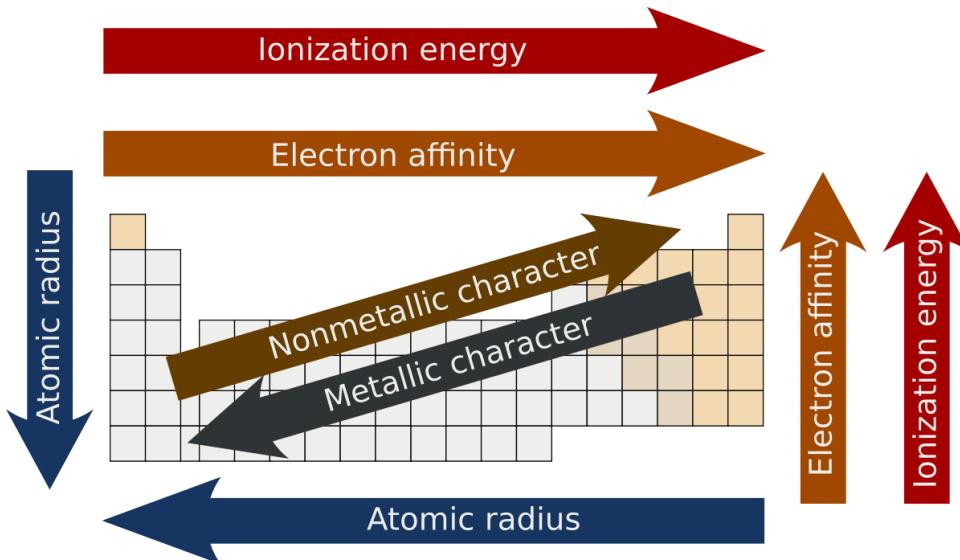
- A. ~~5, 3, 0~~
- B. 5, 2, 0
- C. 4, 2, 2
- D. 4, 4, 0



[April 15, 2018 (II)]

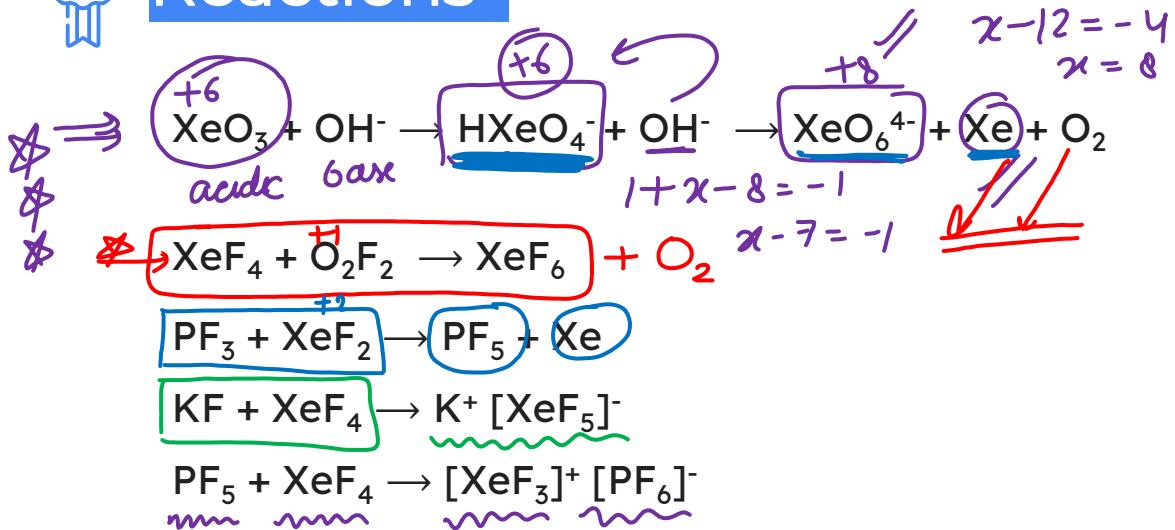


Reactions of Xe compounds





Reactions



$$x - 5 = 0 \\ x = +5$$



$$x - 6 = -1 \\ x = +5$$



The reaction in which the hybridisation of the underlined atom is affected is :

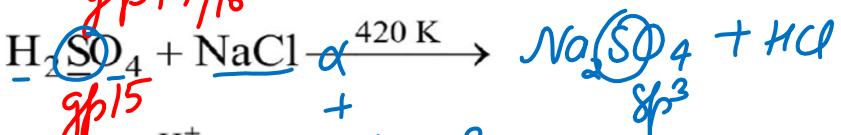
CB

gp15

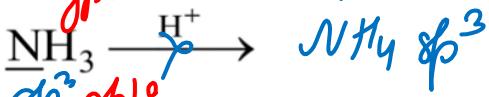
A.



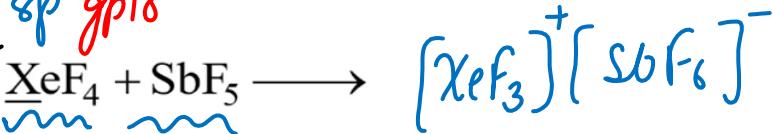
B.



C.



D.



JEE Main 2020

$\Rightarrow \chi_e:$

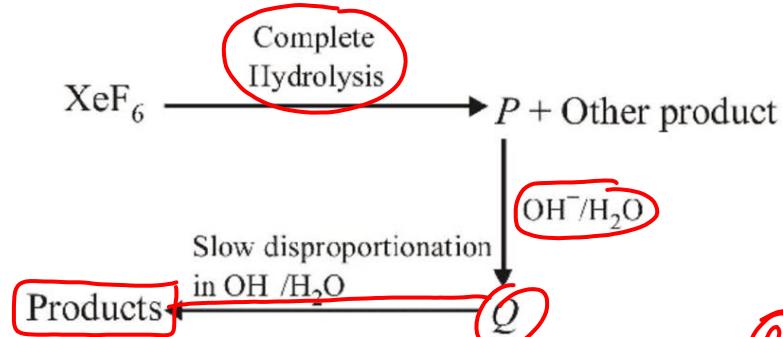
$\nwarrow 4+2$
 sp^3d^2

$O \chi_e =$

$3+2 = sp^3d$

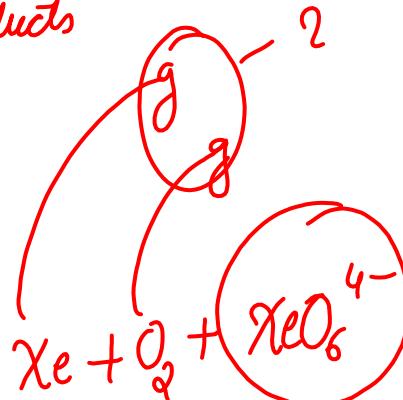
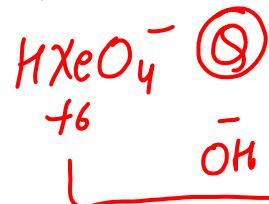
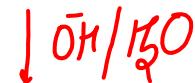
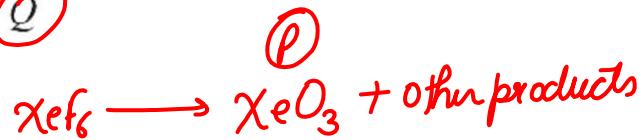


Under ambient conditions, the total number of gases released as products in the final step of the reaction scheme shown below is



[Adv.
2014]

- A. 0
- B. 1
- C. 2
- D. 3





At 143 K, the reaction of XeF_4 with O_2F_2 , produces a xenon compound Y. The total number of lone pair(s) of electron present on the whole molecule of Y is _____

19

4



[Adv. 2019]



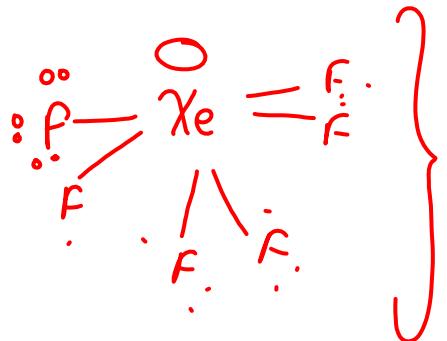
$$\frac{1}{2}[8+6] =$$

$$7$$

BP = 6

LP = 1

$8p^3d^3$



$$\frac{+1}{19}$$

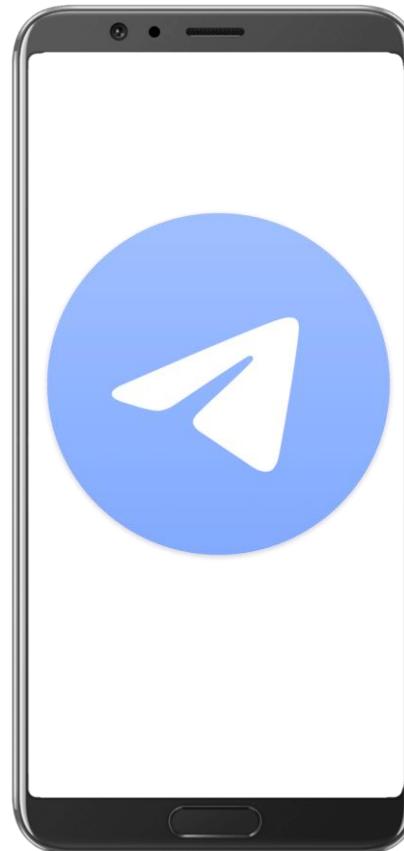
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For JEE Main and Advanced 2022



17th November, 2021



Nishant Vora



Praveen Kumar Pachuri



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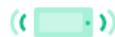
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Upcoming Batches in November



Revision Batch (Class 12th & Dropper) : JEE Main & Advanced 2022 Starts on **3rd Nov. 2021**

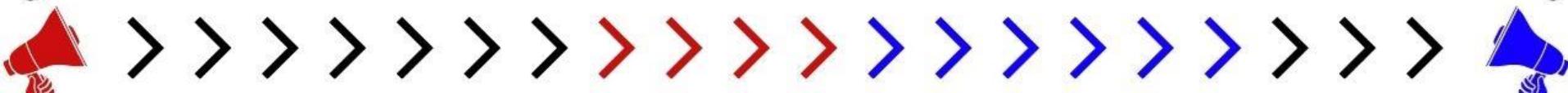
Revision Batch (Class 12th) : JEE Main & Advanced 2022 Starts on **10th Nov. 2021**

Rapid Revision Batch (Class 12th & Dropper) : JEE Main & Advanced 2022 Starts on **10th Nov. 2021**

Revision Course Batch (Class 11th) : JEE Main & Advanced 2023 Starts on **17th Nov. 2021**

Rapid Revision Batch (Class 12th & Dropper) : JEE Main & Advanced 2022 Starts on **17th Nov. 2021**

Revision Course Batch 2.0 (Class 11th) : JEE Main & Advanced 2023 Starts on **24th Nov. 2021**



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GROUP STAGE	14th & 21st November	25	1-2 PM
FINALS	28th November	75	1-4 PM





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Scholarship
AV worth 2000*

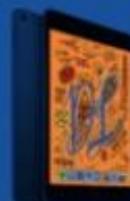


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