DATE: __/__/____
PAGE: _____

L-1/13 (Ch.-4)

CHEMICAL-BONDING & MOLECULAR STRUCTURE

CHEMICAL-BOND:

It is the force that binds the atoms to give the together within a chemical species.

Types:

1) Ionic / electrovalent
2) covalent
3) Dative / Co-ordinate
4) Metallic
5) Van-Der waals forces

IONIC-BOND → electrostatic force of attraction

Metal and Non-metal react with each other to form Ionic-Bon

Eg. Formation of MgO

Mg (2,8,2) + O (2,6) → electrostatic force of attraction i.e. IONIC-BOND

Mg^{2+} (2,8) ⋯⋯ O^{2-} (2,8)

★ BORN-HABER CYCLE

(1) MgO

$Mg(s) + \frac{1}{2}O_2(g) \longrightarrow MgO(s)$

+Ve = ΔH_{sub} ↓ Mg(g)

+Ve = $\Delta_i H_1$ ↓ Mg^+

+Ve = $\Delta_i H_2$ ↓ Mg^{2+}

Good Price

$\frac{1}{2}\Delta_{B.E}H$ ↓ O(g)

$\Delta_{eg}H_1 = -ve$ ↓ O^-

$\Delta_{eg}H_2$ ↓ O^{2-}

$\Delta_{L.E.}H$ → lattice Enthalpy

release or absorb ??

* {Energy = magnitude} * Enthalpy → +ve or -ve

DATE: __/__/____
PAGE: _____

$\Delta_f MgO$ → enthalpy of formation of MgO

$$\Delta_f H_{(MgO)} = \Delta H_{sub} + \Delta_i H_1 + \Delta_i H_2 + \frac{1}{2}\Delta_{BE} H + \Delta_{eg} H_1 + \Delta_{eg} H_2 + \Delta_{Le}$$

$\frac{1}{2}\Delta_{BE} H$ → Bond Dissoc^n energy

More Negative the value of enthalpy of formation, more stable will be the product

Factors favouring the formation of Ionic-bond:

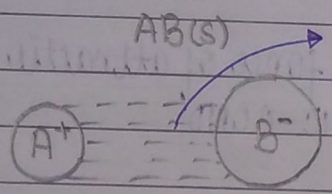
① enthalpy of atomization of the Metal and the Non-metal should be Low (less +ve).

② Ionization enthalpy of Metal should be Low.

③ Electron gain enthalpy of the Non-metal should be More Negative.

④ Lattice Energy of the Ionic solid should be High. (More Negative)

Covalent Characters in Ionic-solid: [FAJAN'S RULE]



100% spherical 100% spherical

|||

100% Ionic-Character

Good Write

DATE: __/__/____
PAGE: _____

polarising power (+)	polarisability (−)
Ability of ~~an atom~~ cation to distort the e^- cloud of Anion towards itself.	Tendency of anion to be distorted by the cation.
* Polarising power ∝ charge Density	* Polarisability ∝ size

$$\text{charge Density} = \frac{\text{charge}}{(\text{size})^2}$$

Fajan's Rule:

Higher the polarising power of cation as well as polarisability of Anion more will be the covalent character in IONIC-SOLID.

Arrange the following in the order of covalent character:

(I) NaF < NaCl < NaBr < NaI (COVALENT CHARACTER)

F^- Cl^- Br^- I^-

Anion size ∝ polarisability

NaI is soluble in Acetone due to its covalent Nature.

(II) LiCl > NaCl > KCl > RbCl > CsCl

$\frac{1}{(\text{Cation size})^2} \propto$ Polarising power

(III) NaF << MgO << AlN

(Na > Mg > Al) > Polarising Power & Polarisability

(F < O < N)

MORE = MORE COVALENT

Good Write

L-2/14

DATE: 12/11/22
PAGE:

cation having more than 8 e^- in its valence shell has more polarising power than a cation having 8 e^- in it.

eg. K^+ Cu^+

2,8,8 2,8,18

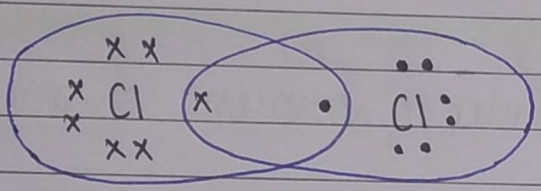
↳ more polarising power

i.e. KCl < CuCl = Covalent Character

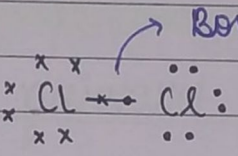
COVALENT-BONDING ⟶ 1) Lewis concept 3) Valence Bond theory
2) VSEPR Theory 4) Hybridization
5) MOT 6) Resonance
7) H-bonding

* LEWIS-CONCEPT OF COVALENT-BONDING:

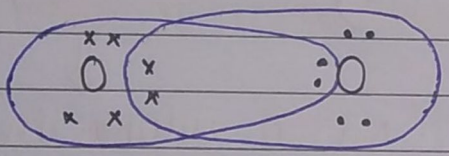
Cl_2



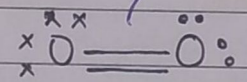
or



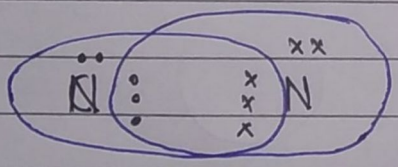
O_2



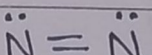
or



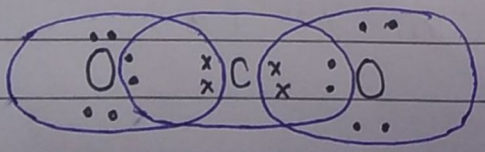
N_2



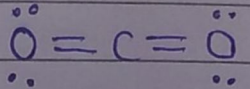
or



CO_2



or

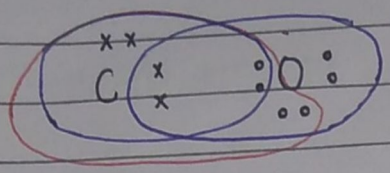


Good Write

* First complete octet of more EN element

DATE: __/__/____
PAGE: _____

CO →



i.e. $\overset{\times}{\underset{\times}{}}C \equiv O:$ → coordinate or Dative Bond (unequal sharing)

Lewis-Stru

N_2O NO_2^+ $N_3^{(-)}$

CN_2^{2-}

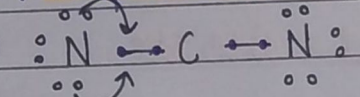
↓

① Total Valence e^- / 2

$= \frac{4+2\times5+2}{2}$

$= 8$ pairs of valence e^-

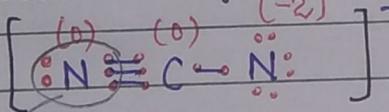
② put ~~valence~~ the least EN at centre + complete the octet of most EN atom(s)

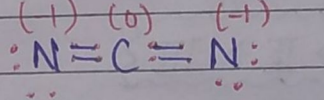


⇓

$:N \equiv C - \underset{\cdot\cdot}{N}:$ ① $:N = C = \underset{\cdot\cdot}{N}:$ ② $\overset{\cdot\cdot}{:}N - C \equiv N:$ ③

* formal-Charge





Net Charge = 0+0+(-2) ; Net Charge = -1-1 = -2

formal = -2 ; formal

↳ Since have 5 close e^-; i.e. Equal valence e^- ∴ formal Charge = Zero

if Have extra = -ve

if Have less = +ve

Good Write

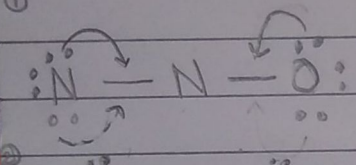
DATE : ___/___/____
PAGE : _____

* N_2O

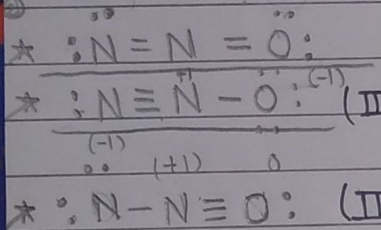
$$\frac{TVE}{2} = \frac{5\times2+6}{2}$$

$$= \frac{16}{2} = 8 \text{ pairs}$$

①



②



(I) → (Resonating str. N_2O)

(II) * Total formal charge = $-1+1+0=0$

(III)

(3 Resonating str.)

* Resonating str. having max. No. of atoms with formal charge zero or close to zero is the most stable str.

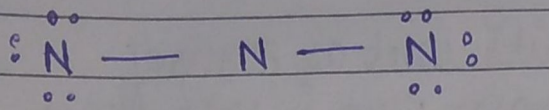
* Resonating str. having Neg. charge on more EN atom is more stable than the resonating str. having -ve charge on less EN atom

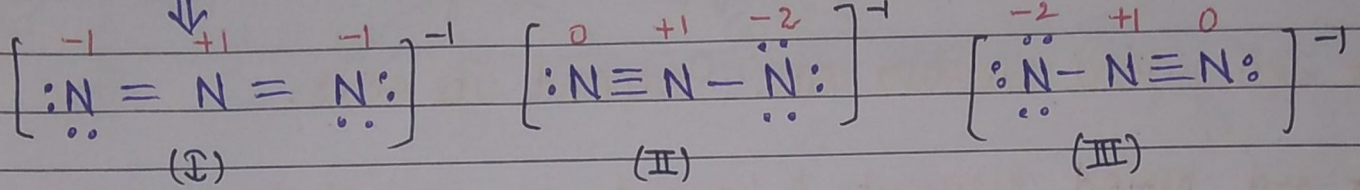
* Stability among I, II, III →

II > I > III

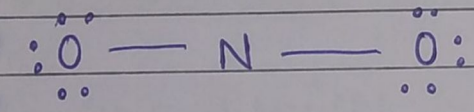
DATE : ___/___/____
PAGE : _____

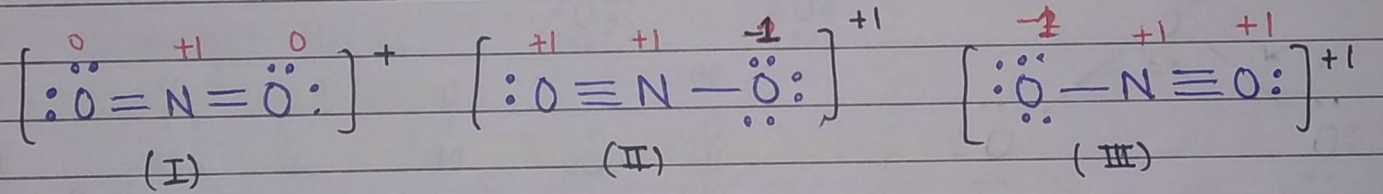
N_3^- $\quad \frac{5\times3+1}{2} = 8$





NO_2^+ $\quad \frac{5+2\times6-1}{2} = 8$

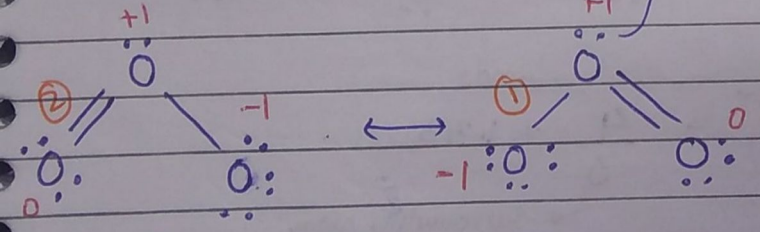




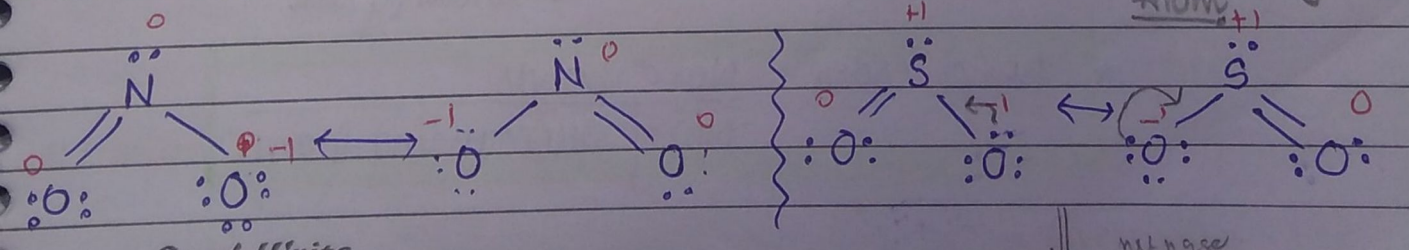
★ "Isoelectronic species having same No. of Atoms are ISO-STRUCTURAL."

Eg. O_3, NO_2^-, SO_2

lp at central Atom, results in bending of str.



O-O bond order in O_3 $= \frac{\text{No. of bonds}}{\text{surrounding Atom}} = \frac{3}{2} = 1.5$

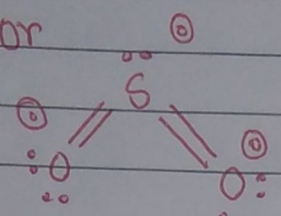


Good Write

next page

DATE: ___/___/____
PAGE: _____

or



(more stable)
↳ sulphur Expand its octet as Atoms of molecule Having formal Charge Zero is MOST-STABLE.

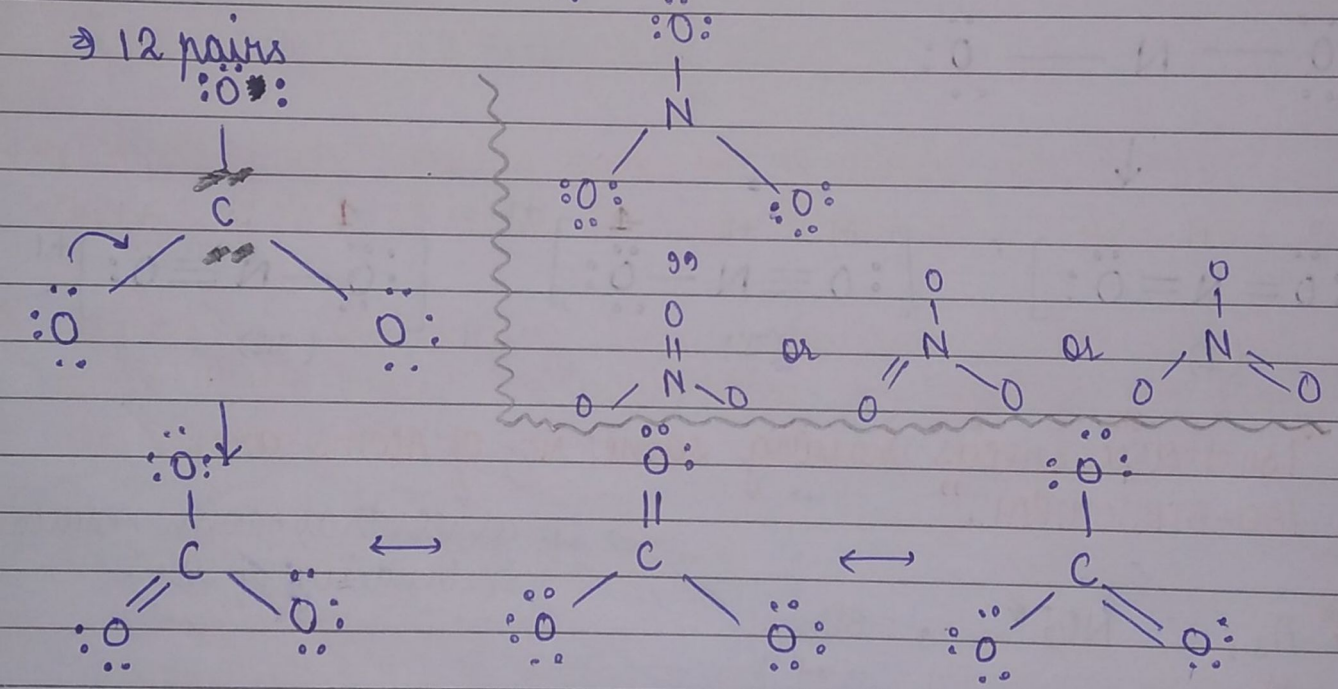
* 2nd period element can't expand its octet.

* 3rd period Elements & beyond can Expand ~~the~~ its octet.

• CO_3^{2-} ; • $NO_3^{(-1)}$ — Isoelectronic with same No. of Atoms, Hence same str(s)

$\frac{4+18+2}{2}$ ⇒ 12 pairs

$\frac{5+3\times6+1}{2}$ ⇒ 12 pairs



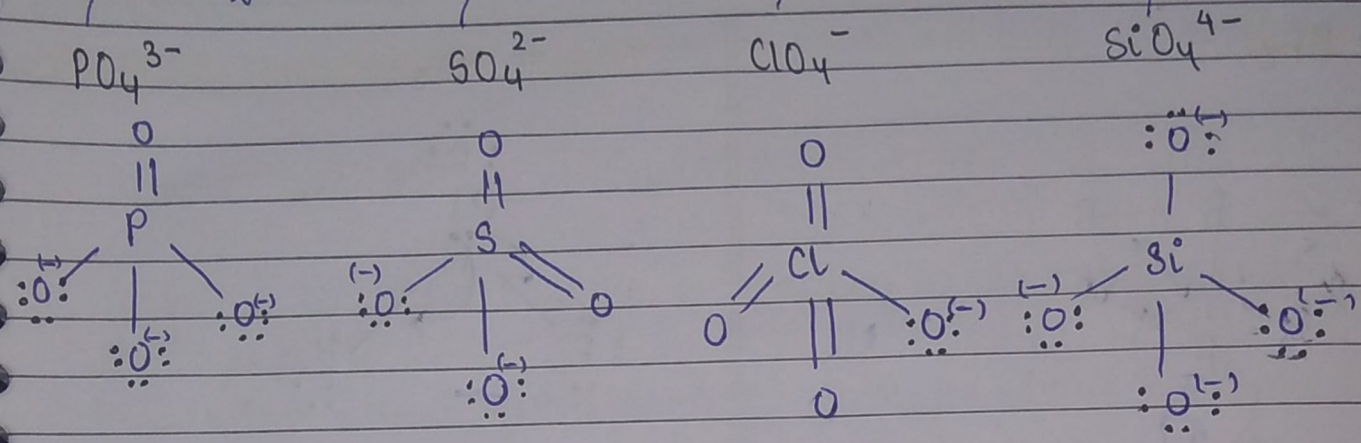
* C–O bond order in CO_3^{2-} = $\frac{4 \text{ (bonds)}}{3 \text{ (surrounding atom)}} = 1.33$

* Bond-order = $\frac{\text{No. of bonds}}{\text{No. of surrounding Atoms}}$

Good Write

* given 4 species are isoelectronic with same No. of Atoms, Hence are ISO-STRUCTURAL.

$\frac{5+24+3}{2} \Rightarrow 16p$ $\quad \frac{30+2}{2} \Rightarrow 16p$ $\quad \frac{7+24+1}{2} \Rightarrow 16p$ $\quad \frac{4+24+4}{2} = 16$



* 'O' with '-ve' charge make single bond.

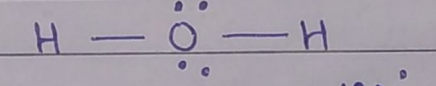
* VSEPR Theory :

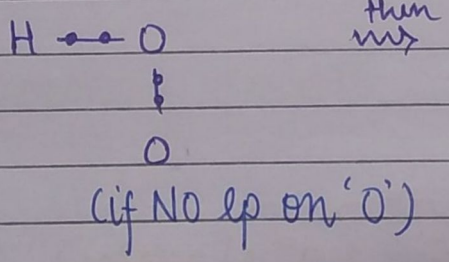
↳ Valence shell electron-pair Repulsion Theory.

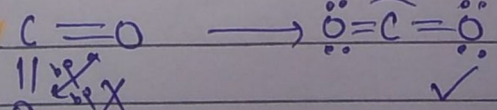
* In a chemical species lp e^- & bp e^- rearrange in such a manner so that there is minimum repulsion amongst them.

* order of repulsion :

lp - lp > lp - bp > bp - bp

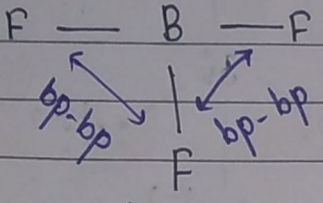
eg. H_2O ⇒ 

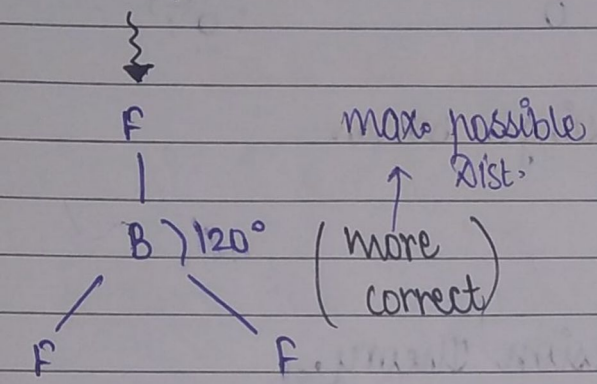


~~or~~ #CO_2 

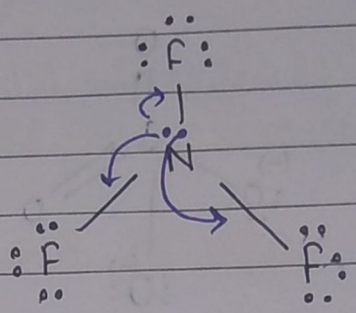
DATE : ___/___/_____
PAGE : _____

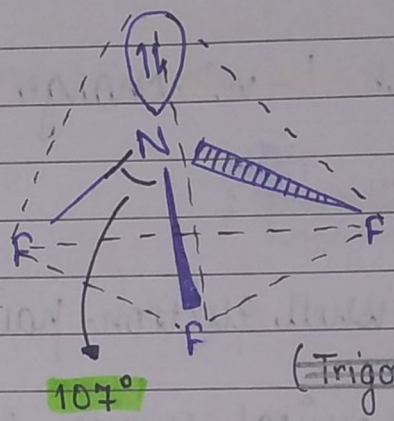
BF_3





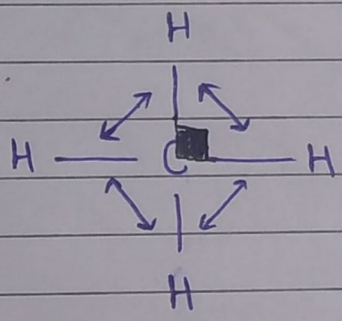
NF_3

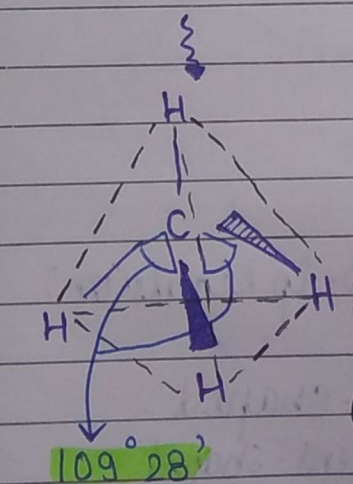




(Trigonal-planar)

CH_4





(Tetraheadral)

* It Has '6' 109°28' angles

Good Write

DATE: 15/11/22
PAGE:

L-3/15

VALENCE-BOND THEORY (VBT)

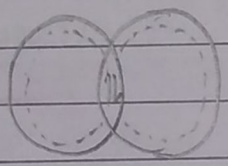
:N≡N: :O=O:

- ✓ Chemical Bond b/w 2 Atoms is formed by overlapping of Atomic Orbitals.
- ✓ Higher the Extent of overlapping, stronger will be the Chemical Bond.
- ✓ In each overlapping, max. of 2 e^- are Involved with Anti-Parallel spins.

Eg. (1) Formation of H_2

H: 1 — $1s^1$

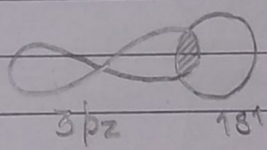
H: 1 — $1s^1$



(2) Formation of HCl

H → 1 — $1s^1$

Cl → 1↓ | 1↑↓ | 1↑↓ | 1↑ — $3s^2$ $3p_x$ $3p_y$ $3p_z$



(3) Formation of He_2

He: 1↓ — $1s^2$

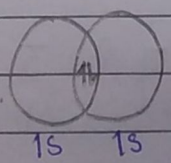
He: 1↓ — $1s^2$

} overlapping of Atomic orbitals is not Possible

(4) Formation of $[HeH]^{\oplus}$

He: 1↓ — $1s^2$

H: □ — $1s^0$



★ Head-on overlapping of At. Orbitals forms σ-Bond whereas side-wise or Lateral overlapping of A.Os forms π-bond.

DATE : ___/___/____
PAGE : _____

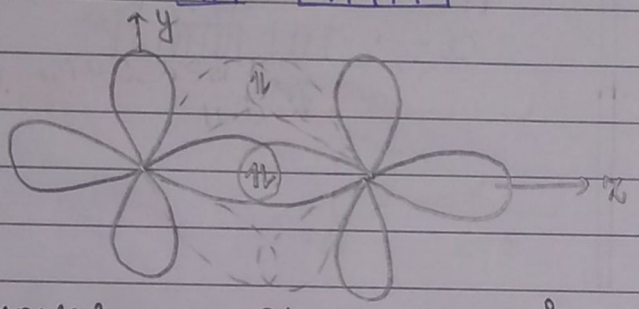
* σ - Bond is stronger than π-bond.
*
* Formation of π-bond b/w 2 Atoms is possible only when there is σ-Bond b/w them.

NOTE :- "In $C_2(g)$ Bond order is 2 & Both Bonds are π-bonds"

"In $B_2(g)$ Bond order is 1 & Bond is π-bond."

Formation of $O_2(g)$ → overlapping b/w same orbitals

	$2s^2$	$2p_x$	p_y	p_z
O :-	↿⇂	↿⇂	1	1
O :-	↿⇂	↿⇂	1	1



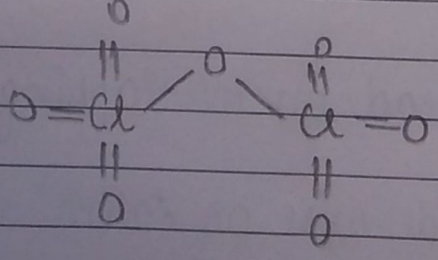
* Acc. to VBT, O_2 should be Diamagnetic, but it is Paramagnetic in Nature.

Covalency of an Atom in a chemical species is the Number of covalent Bonds formed by it in the chemical species.

Eg. * PCl_5 → covalency of P = 5
" " Cl = 1

* PH_3 → covalency of P = 3
" " H = 1

* Cl_2O_7 → covalency of Cl = 7
" " O = 2



$Na_2B_4O_7$

DATE: ___/___/____
PAGE: _____

* covalency of an Neutral Atom = No. of unpaired e^-'s present in it during Bond formation

un-pair e^- = 3

P: $3s^2$ (1↓) $3p^3$ (1 1 1) $3d^0$ ( ) ⟶ 3 Covalancy

Excite

P*: $3s^1$ (1) (1 1 1) (1 | | | |) ⟶ 5- covalency

↳ during Bond formation

TETRAVALENCY OF CARBON

C: $2s^2$ (1↓) $2p^2$ (1 1) ⟶ Ground state

C*: S (1) p_x (1) p_y (1) p_z (1) ⟶ Excited state

H H H H

acc. to VBT: 1 Type Bond, ↳ 3 2nd Type Bond (But in real, All 4 Bonds are similar)

sp^3 sp^3 sp^3 sp^3 ⟶ Hybridization

1 1 1 1

H H H H

CONCEPT OF HYBRIDIZATION

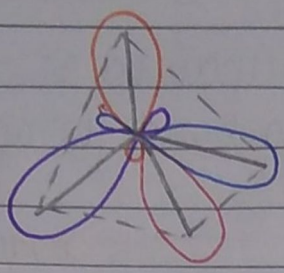
"The phenomenon of Intermixing of A.Os of an Atom to form Hybrid orbitals of "equal energy" and Equal in No. of AOs intermixed is called HYBRIDIZATION.

TYPE	ORIENTATION OF HYBRID ORBITALS
* sp	180° sp sp – LINEAR
* sp^2	120° 120° 120° – TRIGONAL PLANAR

Good Write

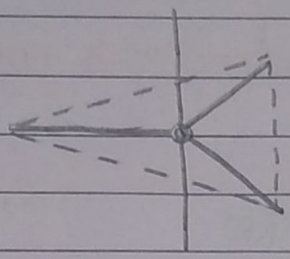
DATE : ___/___/_____
PAGE : _____

* sp^3



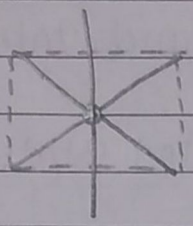
⇒ Tetrahedral

* sp^3d
↓
dz^2



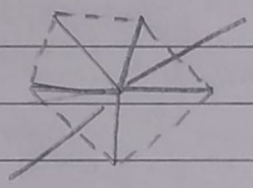
Trigonal-bipyramidal

* sp^3d^2
↙ ↘
dx^2-y^2 dz^2



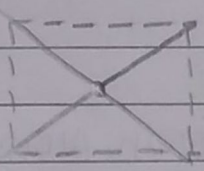
Square-Bipyramidal or Octahedral

* sp^3d^3
↙ ↓ ↘
dx^2-y^2 dz^2 dxy



Pentagonal-bipyramidal

* dsp^2
↓
dx^2-y^2



Square-Planar

* Finding Hybridization :-

- XeO_2F_2
  - 8 − 2×2 − 1×2 = 2 e⁻ (Valence e⁻)
    - 2 e⁻ needed for an 'O' to complete its octet
    - 1 e⁻ " " 'F' "
  - ↓
  - ∴ l.p. = 2/2 = 1

Hybrid-orbitals = surrounding + lp atom
= 4 + 1
= 5
↓
sp^3d

DATE : __/__/____
PAGE : _____

- $XeOF_4$

↓

$8-2-4\times1 = 2e^-$

$lp = 1$

$HO = 5+1 = 6$

↓

sp^3d^2

↳ with 1 lp on 'Xe'

- $I_3^{\oplus}$

↓

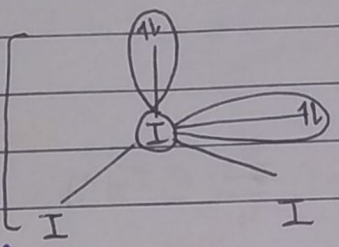
$7-1-1-1 = 4e^2$

$lp = 2$

$2+2 = 4$

↓

sp^3 with 2 lp



* "orientation / Arrangement of e^- pairs around central atom in $I_3^{\oplus}$ is Tetrahedral."

* shape or Geometry or str. of $I_3^{\oplus}$ is Bent or V-Shaped

↳ see Atoms

V-shaped
or Bent shaped

Ques. 23 / PYQ

* XeF_4

$8-4\times1 = 4$

$lp = 2$

$4+2 = 6$

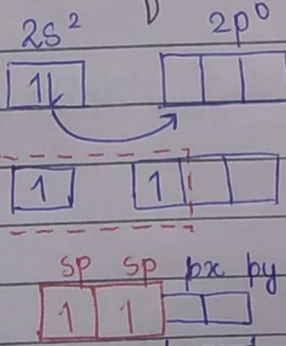
sp^3d^2 with 2 lp

↳ Geometry = square planar
orientation = Octahedral

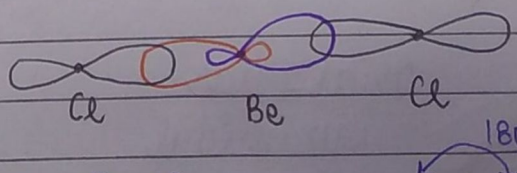
sp- hybridization

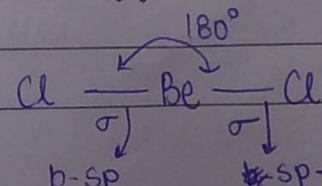
Eg ① Formation of $BeCl_2$

Geometry / shape = "Linear"



→ Ground state





Good Write

L-4/16

DATE: 19/11/22
PAGE:

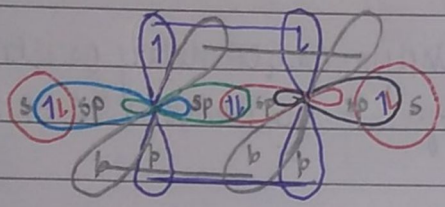
eg.② Formation C_2H_2

C: 1↓ | 1 1 | } ground state
$2s^2$ $2p^2$

C*: 1 | 1 1 1 | → Excited state

sp sp p p
1↓ 1↓ 1 1

sp sp
H – C ≡ C – H
surrounding + lp atom
2 + 0 ⇒ 2
↓
sp

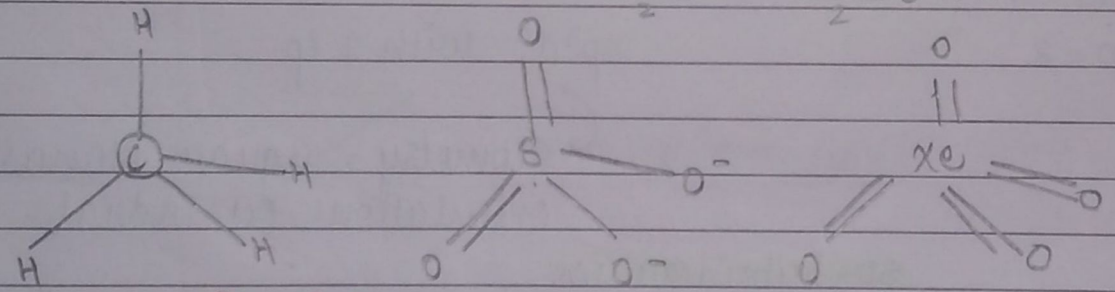


H – C ≡ C – H
(π, π)

sp^3 → tetrahedral
↳ of central Atom

① sp^3 + 0 lp

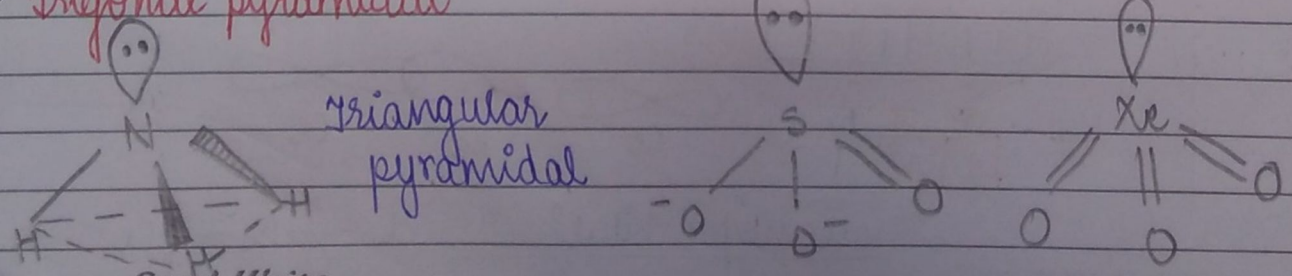
CH_4, SO_4^{2-}, PO_4^{3-}, ClO_4^-, XeO_4
4-4=0 lp
$\frac{6-8+2}{2}=0$
$\frac{5-8+3}{2}=0$ ...



↳ of Hybrid orbital

② SP^3 + 1 lp
↳ shape / geometry: ↳ trigonal pyramidal

NH_3, SO_3^{2-}, XeO_3, ClO_3^-

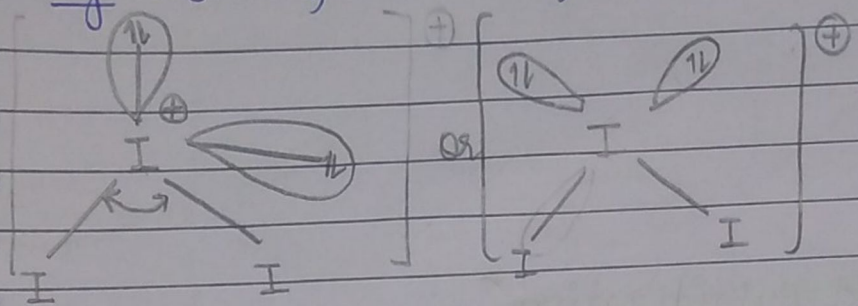


Triangular pyramidal

DATE : __/__/____
PAGE : _____

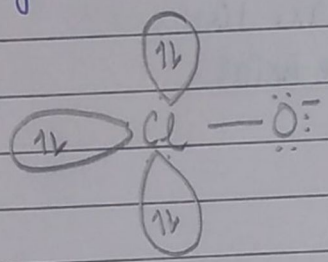
③ sp^3 + 2lp (on central Atom)
↳ shape / Geometry
= Bent / V-shaped
(Lewis str. is not similar to others)

Eg. I_3^+ , ClO_2^- , H_2O



④ sp^3 + 3lp
If No. of lp on central Atom is 3, then shape / geo. would be linear

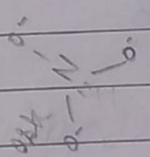
Eg. ClO^-



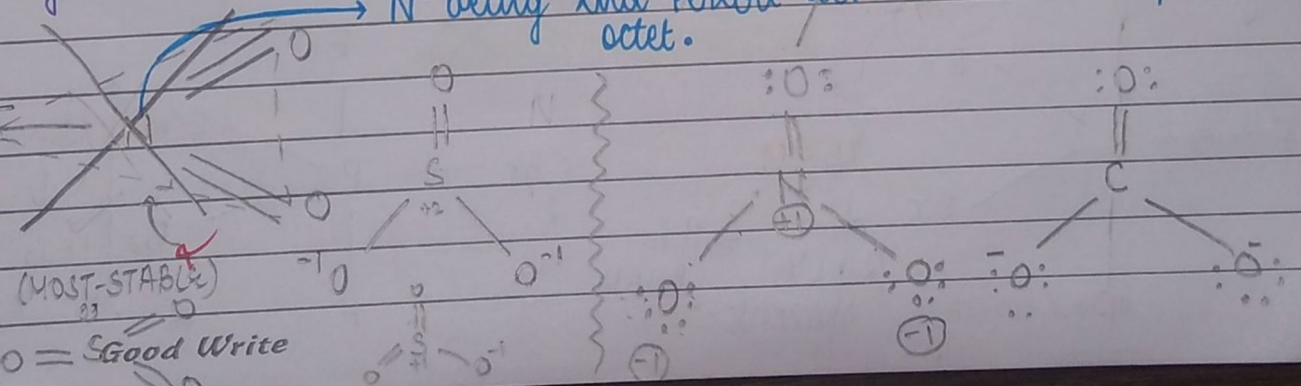
sp^2 - hybridization

① sp^2 + 0 lp (on central Atom)
↳ Geo / shape
↳ Trigonal planar

Eg. CO_3^{2-} , NO_3^- , SO_3



→ 'N' being 2nd period element does not Expand its octet.



O = S

Good Write

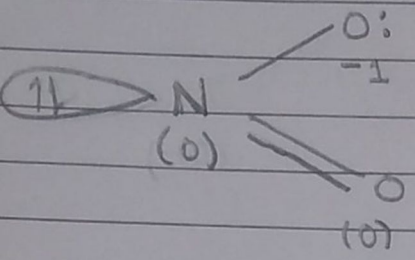
DATE: ___/___/____
PAGE: _____

(on central Atom)

② sp^2 + 1 lp

Eg: SO_2, NO_2^-

$6-2\times2 \Rightarrow 2e^- \rightarrow 1lp$ $\qquad$ $\frac{5-2\times2+1}{2} \Rightarrow 1lp$

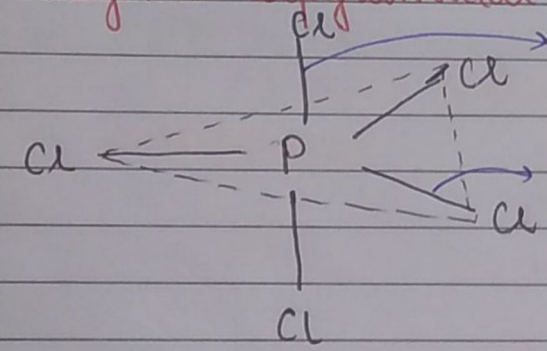


* sp^3d Hybridization *

① sp^3d + 0 lp (on central atom) $\qquad$ PCl_5, PBr_3F_2 $\qquad$ PBr_2F_3

⇓

Trigonal Bipyramidal



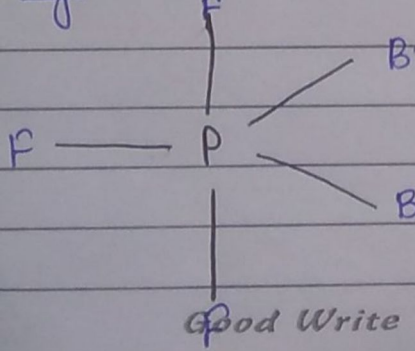
{NOTE: put more EN atom at max. distt. Here Axial}

* n (<90°) = 6
* n (<120°) = 3

* "In sp^3d (PCl_5), axial Bond is longer in length than equatorial Bond"

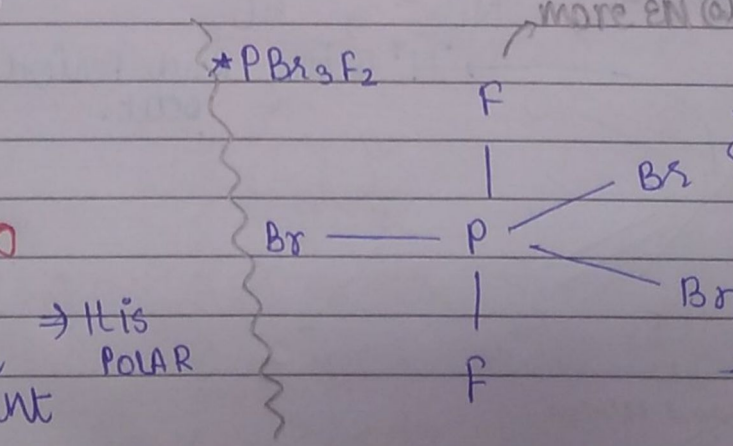
* No. of Cl–P–Cl linkages in PCl_5 is : 10.

Eg. PBr_2F_3



$\mu \neq 0$ ↓ Dipole Moment ⇒ It is POLAR

* PBr_3F_2

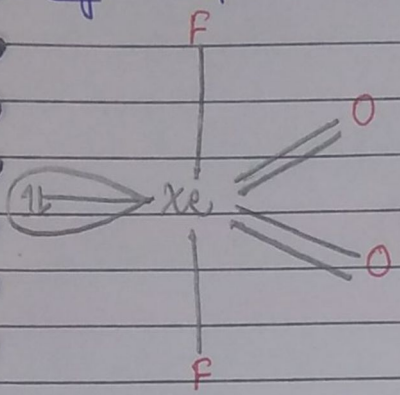


$\mu = 0$ ↓ It is Non-Polar

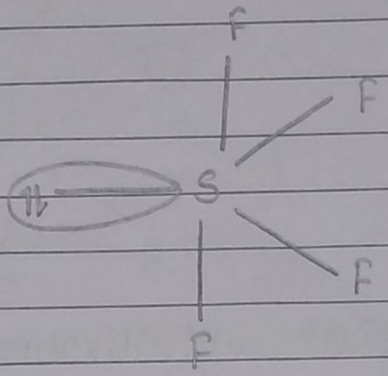
DATE : ___/___/____
PAGE : _____

★ sp^3d + 1lp
↳ shape / Geometry
↳ See-saw

Eg. SF_4

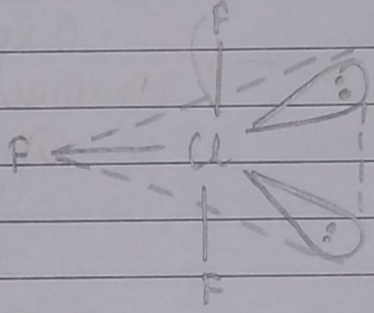


XeO_2F_2



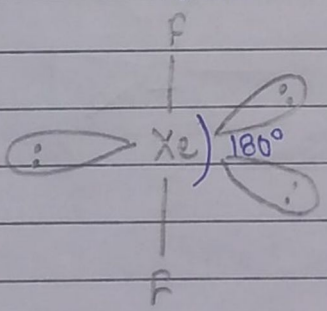
★ sp^3d + 2lp
↳ shape / Geo
T-shape
(Distorted)

ClF_3

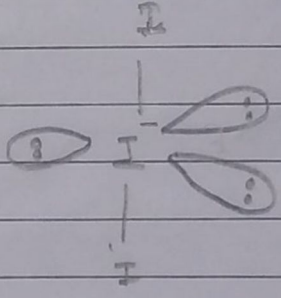


★ sp^3d + 3lp
↳ linear

XeF_2



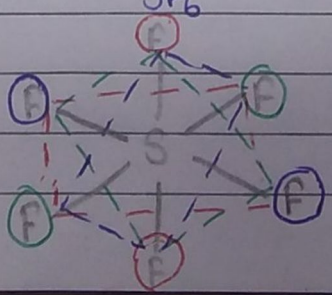
I_3^-



sp^3d^2 hybridization

★ sp^3d^2 + 0 lp
shape / Geo
↳ Octahedral or square bipyramidal

SF_6



All S-F Bonds are Identical in SF_6

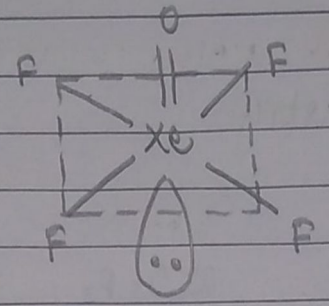
Good Write

Dipole

DATE: __/__/____
PAGE: _____

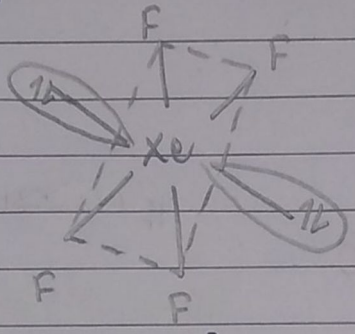
sp^3d^2 + 1 lp → $XeOF_4$

Geo / shape
↳ square pyramidal



sp^3d^2 + 2 lp → XeF_4

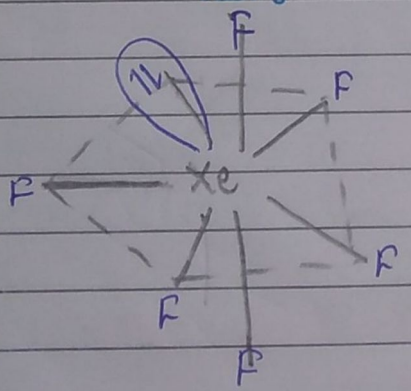
Geo / shape
↳ square Planar



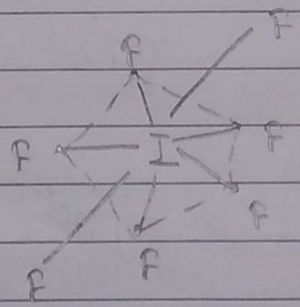
sp^3d^3 Hybridization

- 1 lp (Distorted octahedral) → XeF_6
- 0 lp (Pentagonal Bipyramidal) → IF_7

XeF_6



IF_7



Good Write

L-5/17

DATE: 22/11/22
PAGE:

Dipole Moment

$\delta+ \quad \delta-$

$H \rightarrow F$

Dipole Moment = q x d

* S.I. unit = C-m

* 1 debyne (D) = 10^{-18} esu-cm

% Ionic character = $\frac{\mu_{observed}}{\mu_{calculated}} \times 100$ (observed: experimental)

$\mu_{calculated} = q \times d$ → given

↳ unit charge

= 1.602×10^{-19} C

= 4.8×10^{-10} esu

Ques: μ_{obs} (HF) = 1.78 D & H-F bond length is 92 pm
Cal. % Ionic character in H-F

$$\frac{\mu_{observed}}{\mu_{calculate}} \times 100 = \frac{1.78}{1.60 \times 10^{-19} \times 92 \times 10^{-12}} \times 100$$

REMINDER "solve the Ques by putting units"

$\Rightarrow \frac{178}{160 \times 92} \times 10^{19+12+2}$

$\Rightarrow \frac{\cancel{178}^{89}}{160 \times \cancel{92}_{46}} \times 10^{33}$

$\Rightarrow \frac{89}{46 \times 16} \times 10^{32}$

$\Rightarrow$

Solution

$\frac{1.78}{4.8 \times 10^{-10} \times 92 \times 10^{-10}} \times 100 \times 10^{-18}$

$\Rightarrow \frac{178}{480 \times 92} \times 10^{22} \times 10^{-18}$

$\Rightarrow \frac{\cancel{178}^{89}}{\cancel{48}_{24} \times 92} \times 10^{3}$

$\Rightarrow \frac{8900 \times 10^3}{2208}$

$\Rightarrow 0.04 \times 10^3 \Rightarrow 40\%$

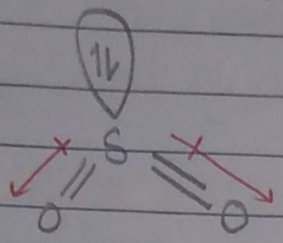
46
3 16
276
46
736

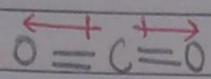
92
24
368
184
2208

Good Write

DATE: __/__/____
PAGE: _____

* SO_2 & CO_2



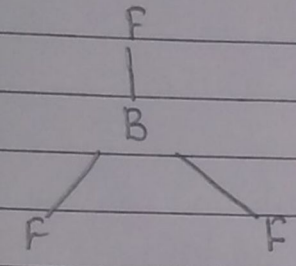


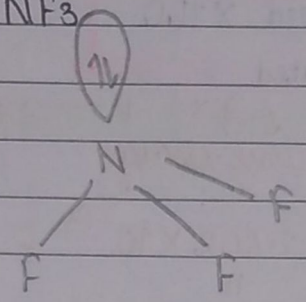
$\mu = 0$

In CO_2, bonds are polar but CO_2 Molecule is Non-Polar.

Polar
i.e. $\mu \neq 0$

BF_3 & NF_3

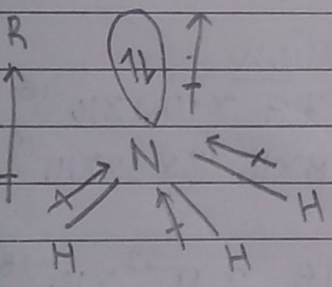


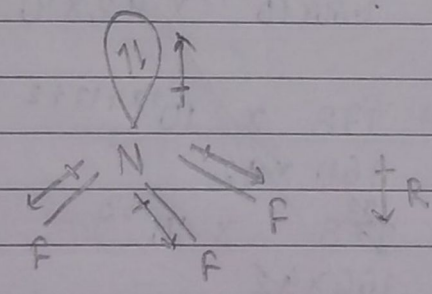


$\mu = 0$
Non-Polar

$\mu \neq 0$, Polar

$\mu_{NH_3} > \mu_{NF_3}$





$H_2O > HF > NH_3 > HCl > CHCl_3$

Dipole moment ↑

Good Write

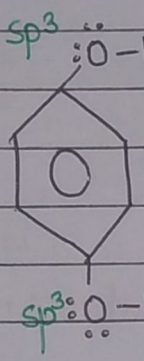
4-7:30
2:30-5:30

DATE: ___/___/_____
PAGE: _____

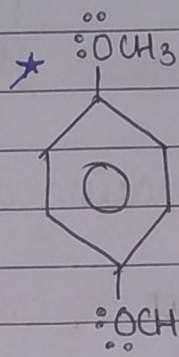
★ $HF > HCl > HBr > HI$ → Dipole moment

★ $CH_3Cl > CH_3F > CH_3Br > CH_3I$ → Dipole moment

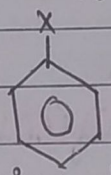
★ $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$ → Dipole moment

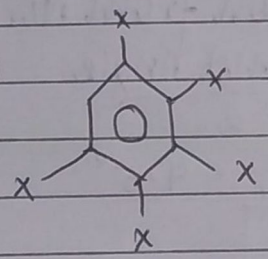
★ 

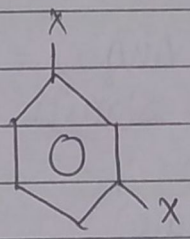
$\mu \neq 0$
"POLAR"

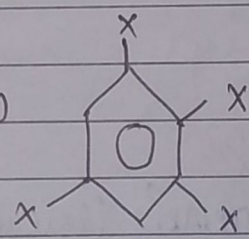
★ 

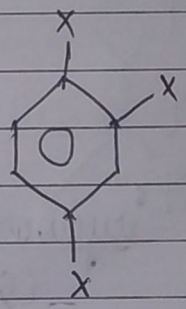
$\mu \neq 0$
Polar

Ques" If a Dipole moment of  is x D, [EN(x) > EN(o)] & x is a small Atom.
Then which of the following has same Dipole moment i.e. x D?

(1) 

(2) 

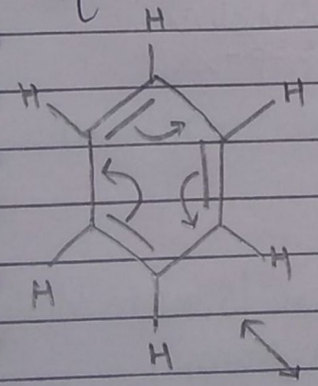
(3) 

(4) 

Ans. All of these.

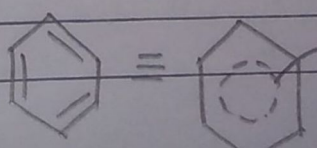
Hint: R is A @ 120°

Resonance



C—C → 154 pm
C=C → 133 pm

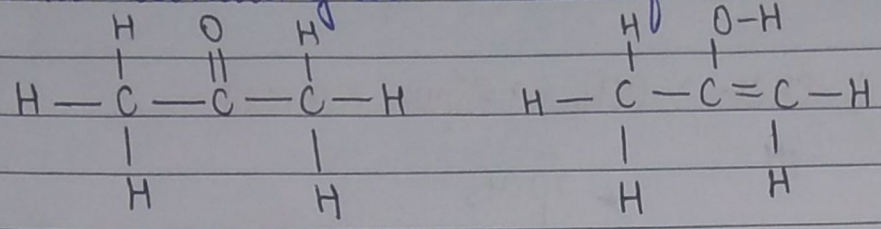
★ In Benzene All C-C Bond lengths are equal i.e. 139 pm.



Good Write

DATE: __/__/____
PAGE: _____

- In order to explain, properties of a Molecules we Draw its various str. called RESONATING STR. or CANONICAL FORM
- In All resonating str. Position of Atoms should be fixed.

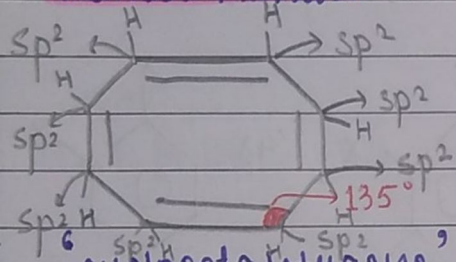


(I) (II)

'I' & 'II' are not resonating str. to each other.

- There is No real Existence of Canonical Forms, Actual str. is Resonance Hybrid str.

★ For Resonance to be significant, Molecule Must Be PLANAR or Almost Planar.



'cyclooctatetraene' (COT)

Angle Strain = Deviation from Normal Bond Angle / 2

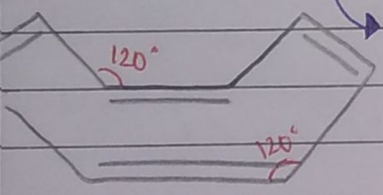
= 135 - 120 / 2 = 7.5°

get to know by hybridisation of carbon (here sp^2 - 120°)

(Exterior Angle)

360/8 = 45° ⇒ 180 - 45 ⇒ 135°

sum of exterior Angle



Tub-shaped

★ Resonating str. Having Max^m No. of Atoms with formal Charge Zero or close to Zero will be most stable str.

★ Resonating str. having -ve charge on E.N. Atom is more stable than the str. having -ve charge on less E.N. Atom

DATE : ___/___/____
PAGE : _____

Resonance energy – always Neg.

★ |Resonance Energy| ∝ stability

★ Higher the No. of resonating str., higher will be stability

Ques": Identify the most stable resonating structure of Nitric oxide (NO)?

(1) $\ddot{N} \equiv \ddot{O}$ (2) $\ddot{N} \equiv \ddot{O}$ (3) $\ddot{N}=\ddot{O}$ (0) (0) (4) $\ddot{N}=\ddot{O}$ (-1) (+1)

(1-2) octet is expanded (str. wrong)

Octet does not comp ☹

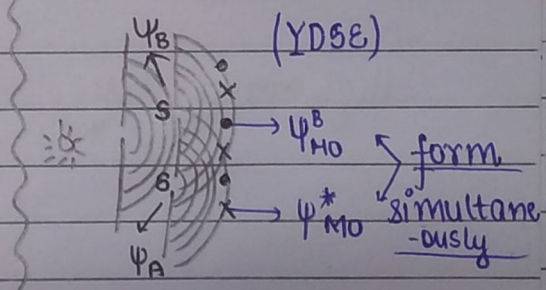
Ans. opt (3)

(elements of 2nd group does not expand its octet)

Molecular Orbital Theory :- MOT is based on LCAO approximation

Acc. to LCAO approximation atomic orbitals of Different Atoms combine to form Molecular orbitals

H (1s¹) ψ_A H (1s¹) ψ_B



$\psi_A \pm \psi_B = \psi_{M.O}$

→ $\psi_A + \psi_B = \psi^b_{M.O.}$

→ $\psi_A - \psi_B = \psi^*_{M.O}$

★ ψ_A & ψ_B are Atomic orbital Wave function

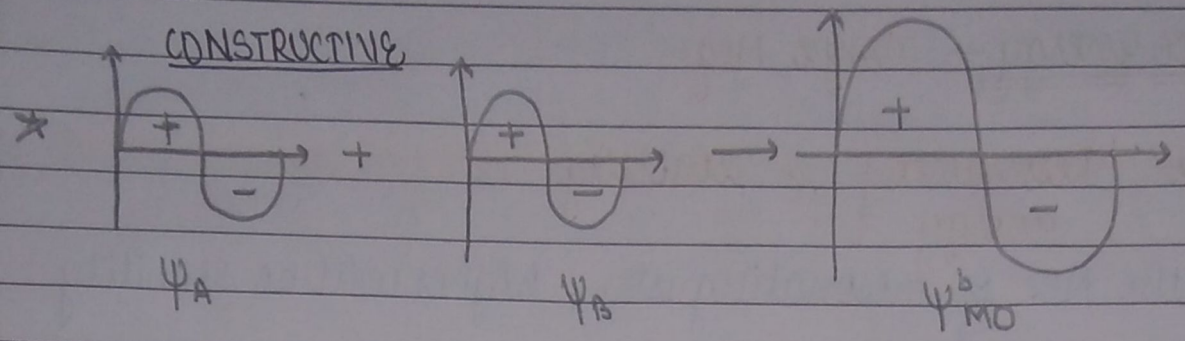
★ ψ^b_{MO} = Bonding Molecular orbital wave function

★ ψ^*_{MO} = Antibonding Molecular orbital wave function

Good Write

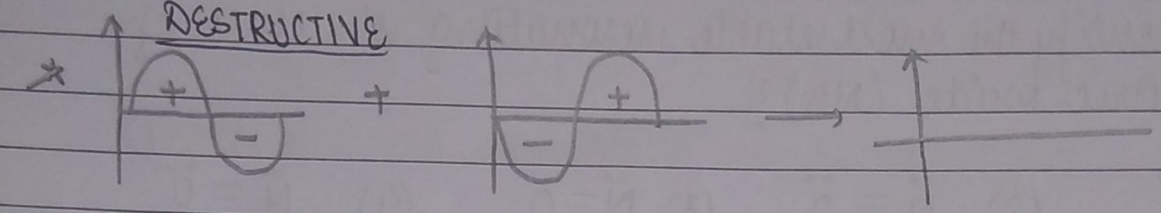
DATE : ___/___/____
PAGE : _____

CONSTRUCTIVE



ψ_A ψ_B ψ^b_{MO}

DESTRUCTIVE



ψ_A ψ_B ψ^*_{MO}

1S 2S | 2px 2py 2pz |

M.O. $\sigma 1S, \sigma^* 1S, \sigma 2S, \sigma^* 2S$

↷ with 2S-2P mixing

→ $\pi 2p_x = \pi 2p_y, \sigma 2p_z, \pi^* 2p_x = \pi^* 2p_y, \sigma^* 2p_z$

↑ use this if N_2^-, N_2^{2-}

B_2 C_2 N_2

→ $\pi 2p_x = \pi 2p_y, \sigma 2p_z, \pi 2p_x = \pi 2p_y, \pi^* 2p_x = \pi^* 2p_y, \sigma^* 2p_z$

↷ without 2S-2P mixing

↑ use this O_2^+, O_2^-, O_2^{2-}

O_2 F_2 Ne_2

↑↓	↑	↑	↑	N
↑↓	↑↓	↑	↑	O

↓

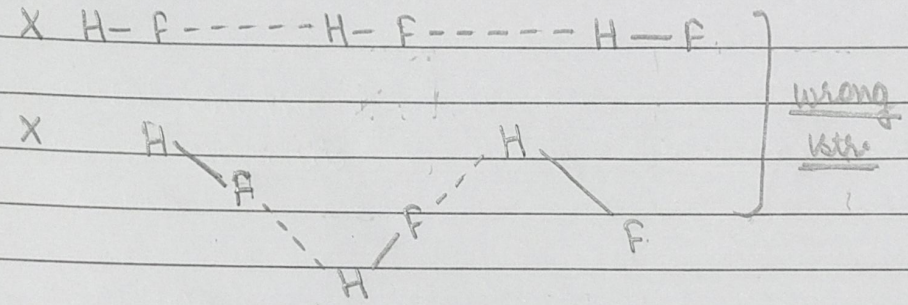
High energy diff.

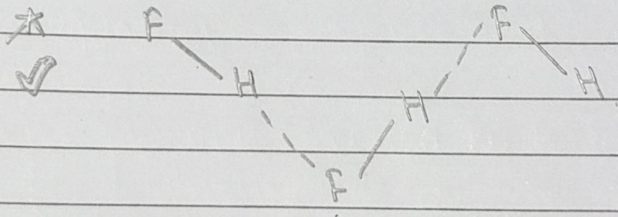
Good Write

DATE : ___/___/_____
PAGE : _____

HYDROGEN-BONDING

★ Hydrogen Bonding energy of H-F > H_2O





↳ VSEPR

↳ Bonding @ 'F' (due to lp-lp repulsion)

→ more No. of H-bonds

★ Boiling Point of HF (ℓ) < H_2O (ℓ)

(20°C) (100°C)

" 19.8°C

★ ~~Boiling Point order~~

- HF > HCl > HBr > HI ⟶ H-Bonding order
- H_2S < H_2Se < H_2Te < H_2O ⟶ BP / MP

- HCl < HBr < HI < HF ⟶ BP ★ All are gases @ Room Temp.
- HCl < HBr < HF < HI ⟶ M.P.

Molecular mass | H-Bonding | Molecular mass

- PH_3 < AsH_3 < NH_3 < SbH_3 < BiH_3 ⟶ BP
- PH_3 < AsH_3 < SbH_3 < NH_3 < BiH_3 ⟶ MP

→ molecular mass
→ Intramolecular force of Attraction

Good Write