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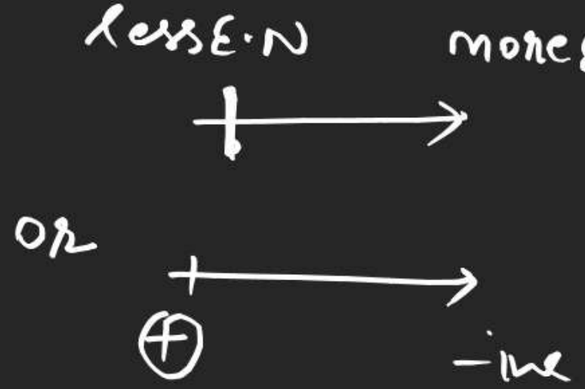
# Dipole moment ($\mu$)

dipole moment is directional prop.



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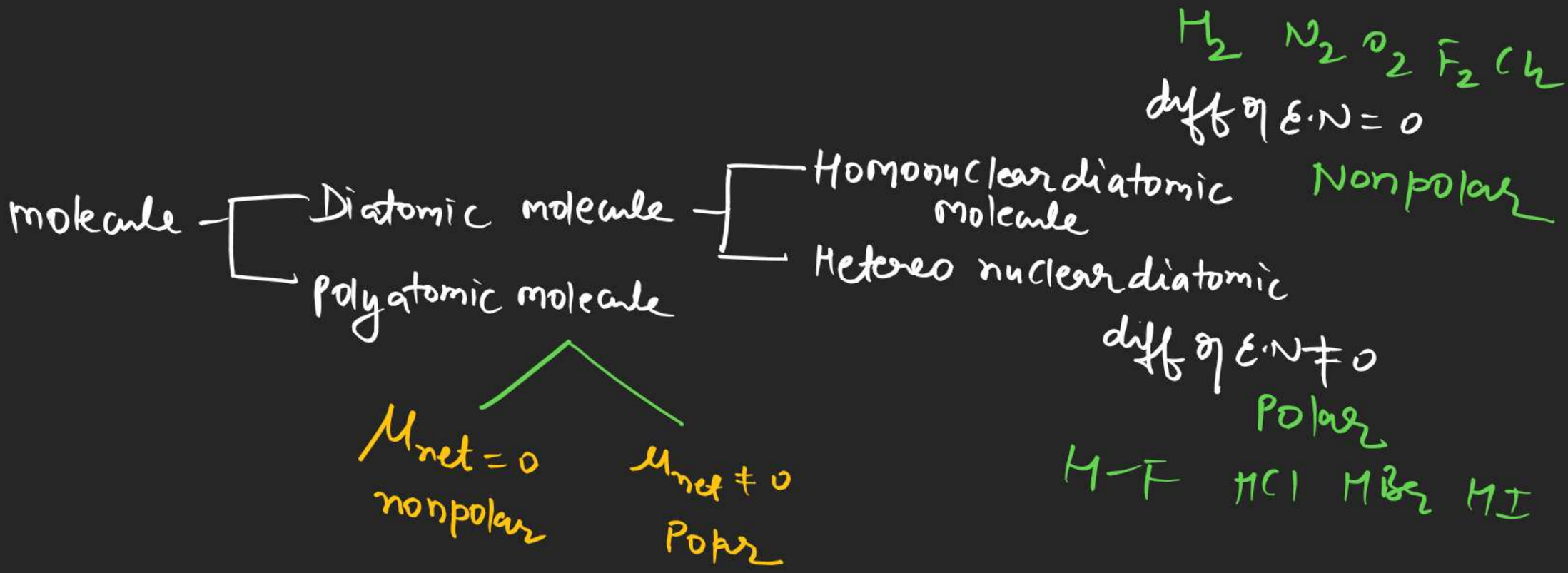

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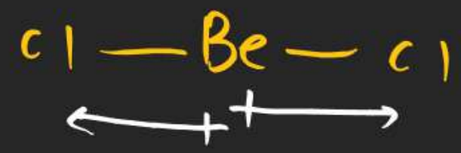
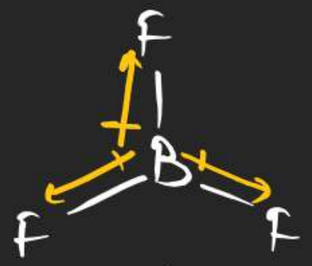



$\mu = 0$ nonpolar




$\mu = 0$, Nunpolar


$\mu \neq 0$, Polar


$\mu = 0$ nonpolar

$\mu = 0$

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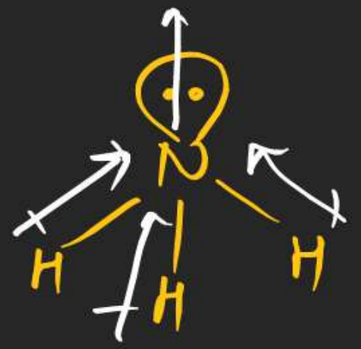
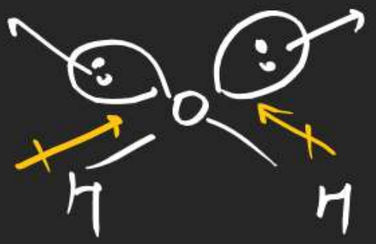
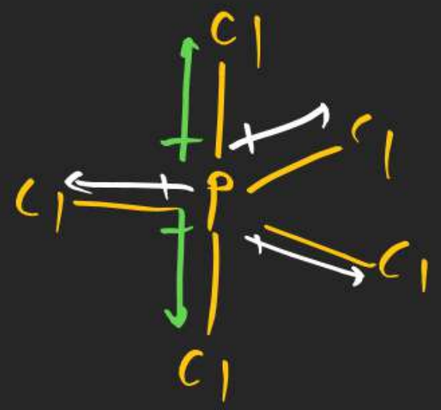



$\mu \neq 0$ Polar




$\mu \neq 0$ Polar




$\mu = 0$ Non polar

$\mu = 0$

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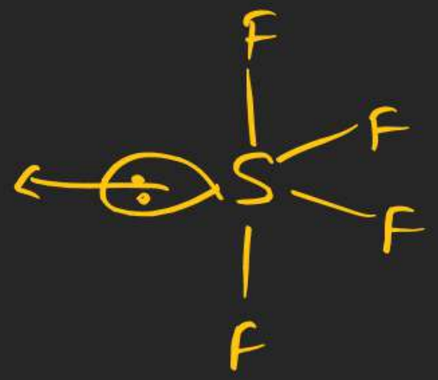
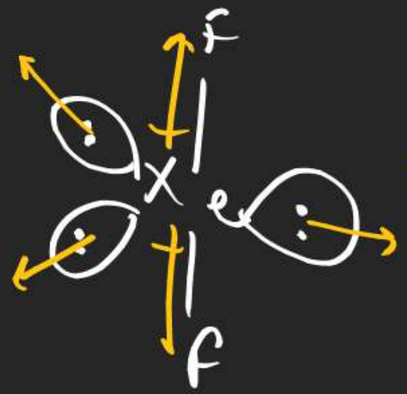



$\mu \neq 0$ Polar


$\mu \neq 0$ Polar




$\mu = 0$ Nonpolar

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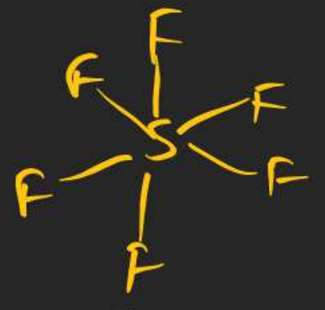
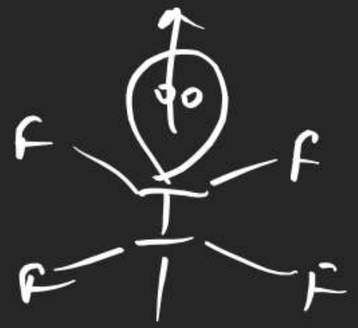
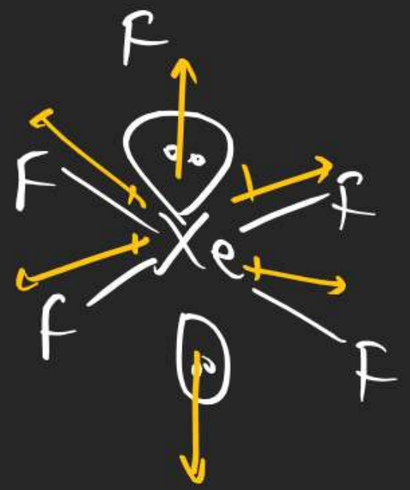



$\mu = 0$, non polar




$\mu \neq 0$ Polar

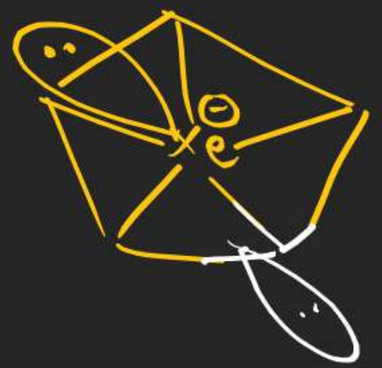



$\mu = 0$ Nonpolar

$IF_7$

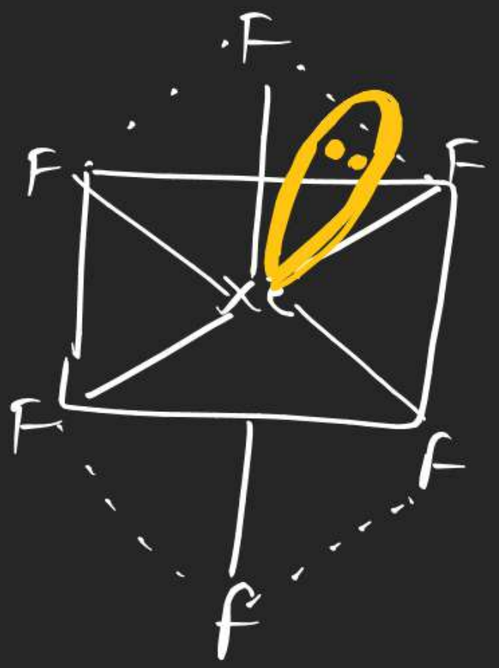
$\mu = 0$, Nonpolar

$XeF_5^{\ominus}$



$\mu = 0$ Nonpolar

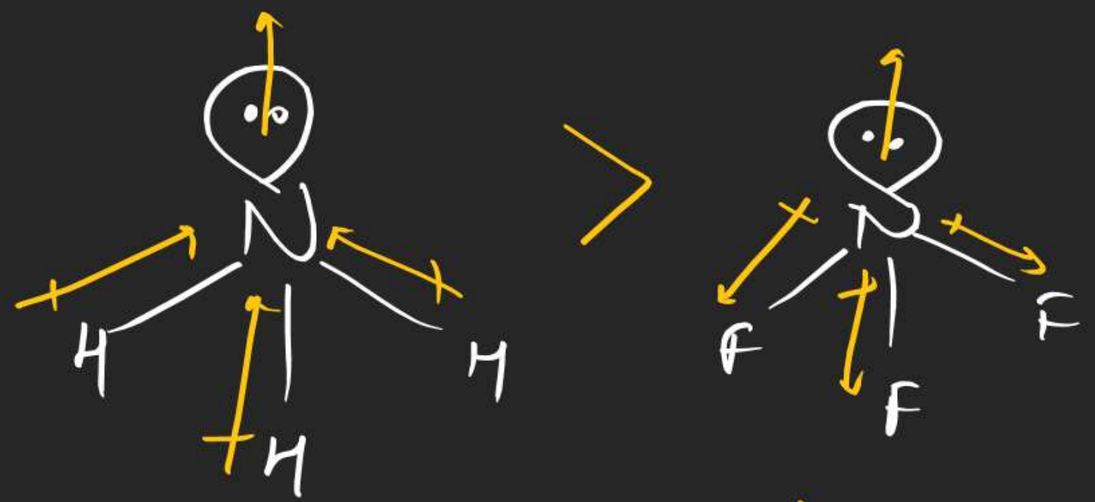
$XeF_6$




$\mu = 0$, nonpolar

L.P is Stereochemically active

Ans Compare dipole moment of $NH_3$ and $NF_3$




Compare bond dipole moment of $NH_3$ and $NF_3$

$N-H$ (3, 2.1, 0.9) $<$ $N-F$ (3, 1, 4)

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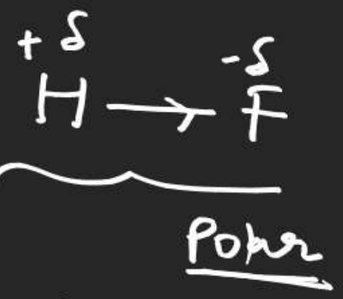


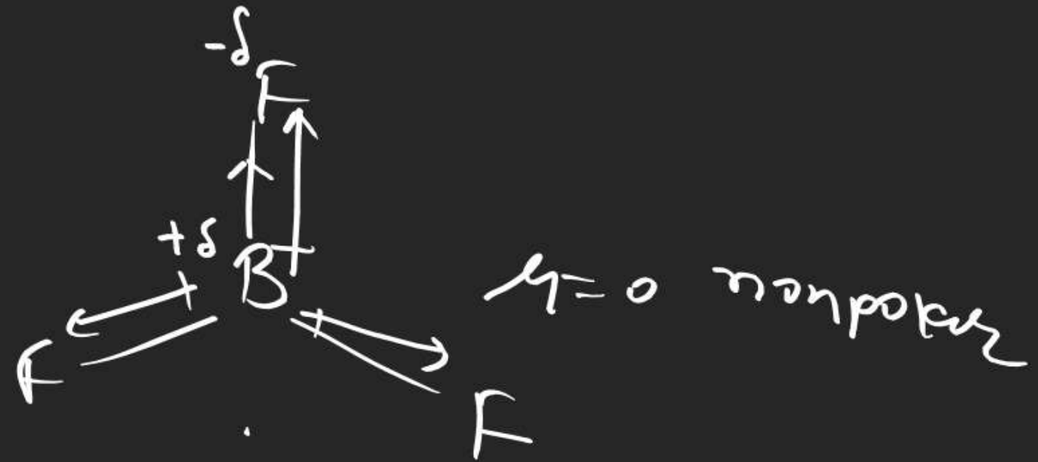


If molecule is non polar then it can have polar bond.

$$u_R = \sqrt{u_1^2 + u_2^2 + 2u_1u_2\cos\theta}$$

$\theta = 0$

$\cos 0 = 1$

$u_R = u_1 + u_2$

$\theta = 180$

$\cos 180 = -1$

$u_R = |u_1 - u_2|$

Keypoint

$\theta \uparrow \quad u_R \downarrow$

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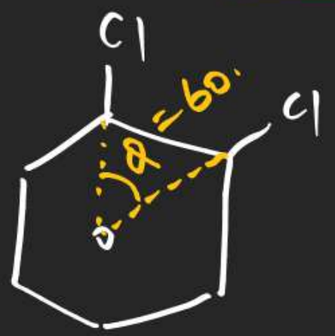
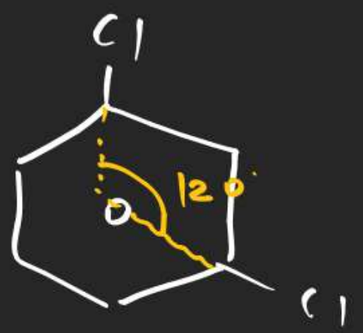
# Order of dipole moment




Ortho




Meta


Para

$\theta \uparrow \quad \mu_R \downarrow$

# Dipole moment ($\mu$)

$$\mu = e \times d \quad \text{esu} \times \text{cm}$$

$e$ = electronic charge

$= 4.8 \times 10^{-10}$ esu / $1.6 \times 10^{-19}$ C

$d$ = distance

$$1\,\text{Å} = 10^{-10}\,\text{m} = 10^{-8}\,\text{cm}$$

Calculate % of Ionic character in HCl molecule if observed dipole moment is 1.03D and distance between H–Cl is 1.275 Å.

Unit

1 Debye = $10^{-18}$ esu × cm

1 Debye = $3.33 \times 10^{-30}$ C · M

$$\% \text{ of Ionic Character} = \frac{\mu_{ob}}{\mu_{th}} \times 100$$

$\mu_{ob}$ = given

$\mu_{th}$ = e × d esu × cm

$$\% \text{ of Ionic} = \frac{1.03 \times 10^{-18}}{\text{extension} \times \text{cm}} \times 100$$

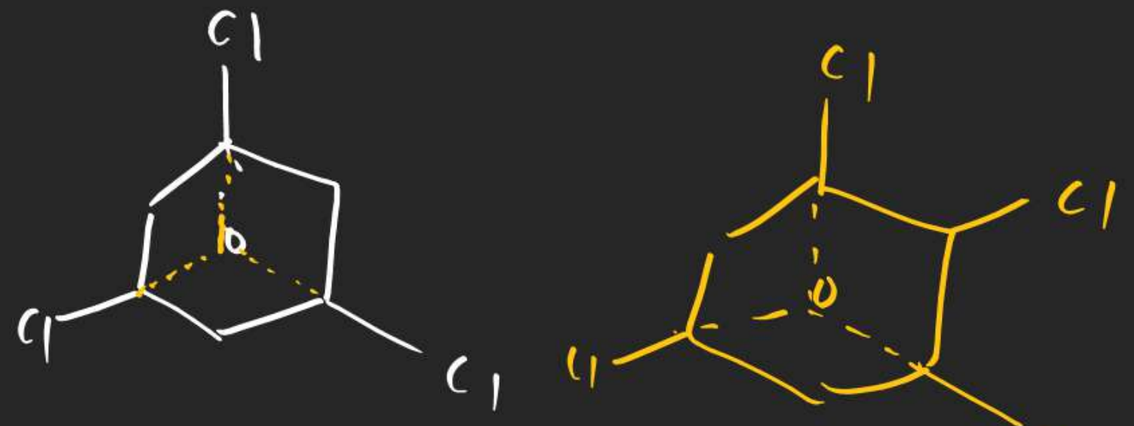
$$= \frac{1.03 \times 10^{-18}}{4.8 \times 10^{-10} \times 1.275 \times 10^{-8}} \times 100$$

$$\approx 17\%$$

Note ⇒

$$CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$$

$$CH_3Cl > CH_3F > CH_3Br > CH_3I$$

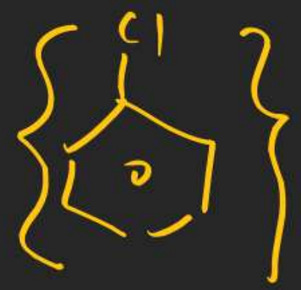



$\mu = 0$ nonpolar

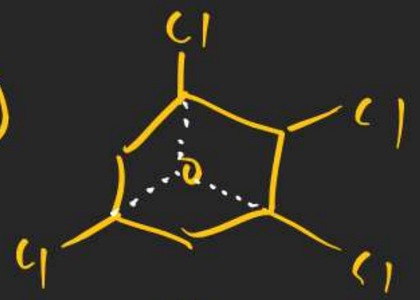
Polar

$\mu \neq 0$

**Qm** Which of the following molecule have same dipole moment with $C_6H_5Cl$



(1)



(2)

(3) both

(4) none

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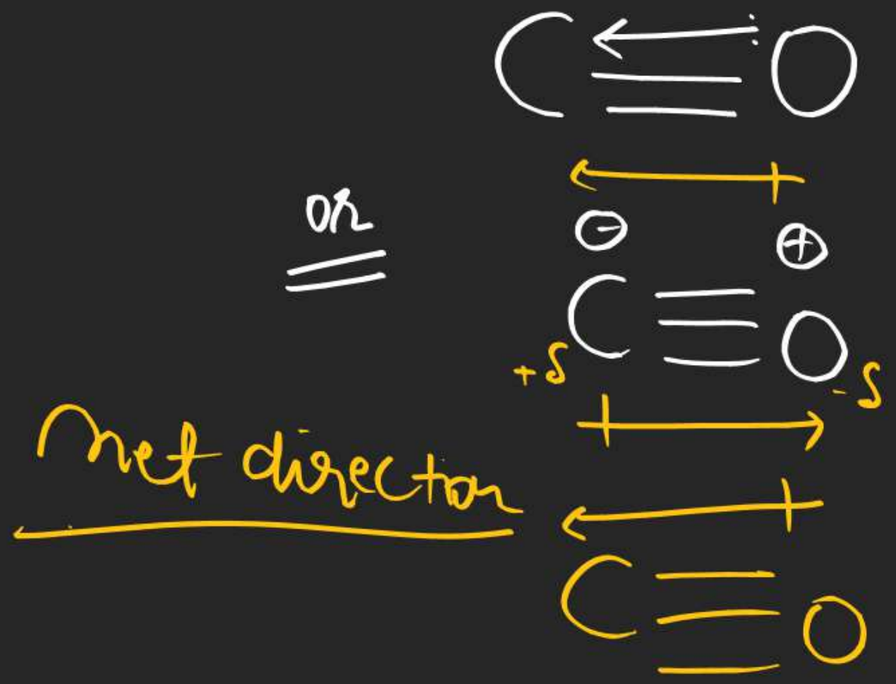
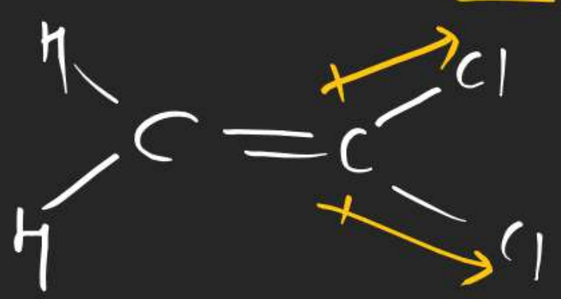
# direction of dipole moment in CO molecule.



JEE Adv

$C_2H_4Cl_2$ find the number of polar isomer

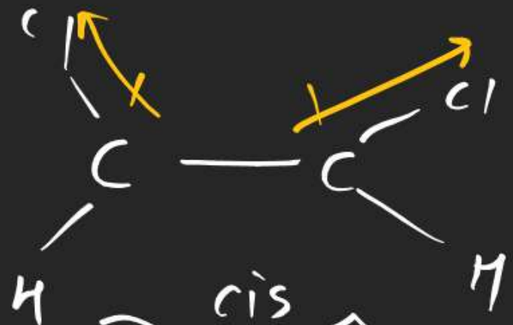
Ans = 2



gem dihalides

$\mu \neq 0$

Polar

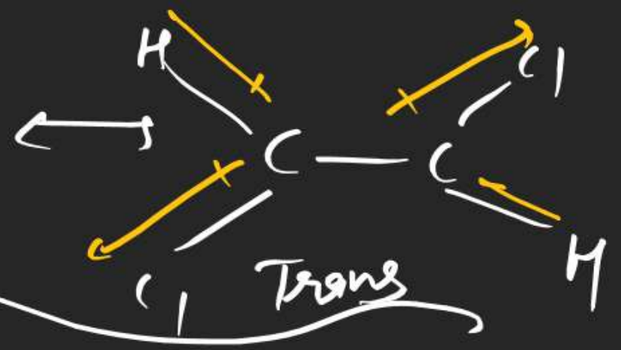


cis

Visinal dihalides

$\mu \neq 0$

Polar



Trans

$\mu = 0$

Nonpolar

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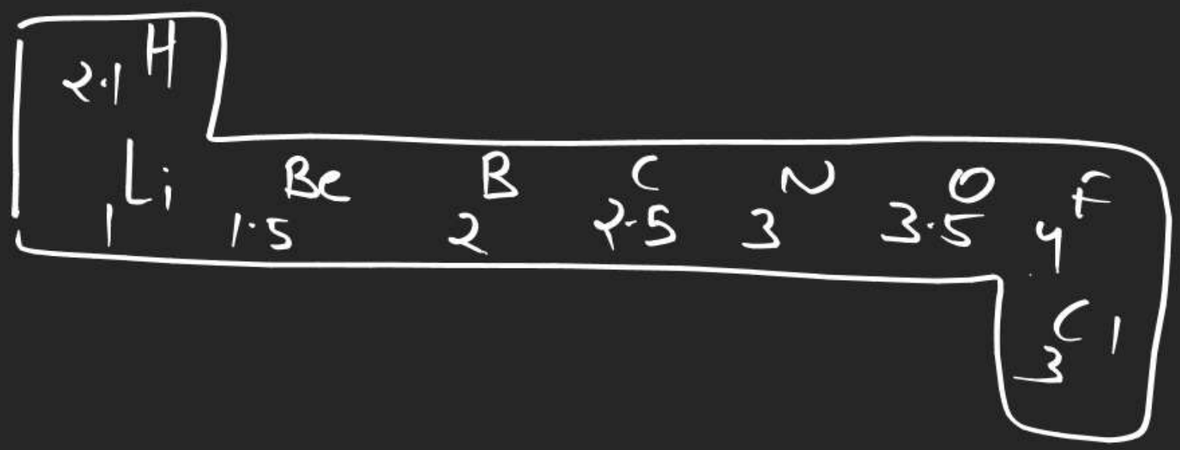
# E·N



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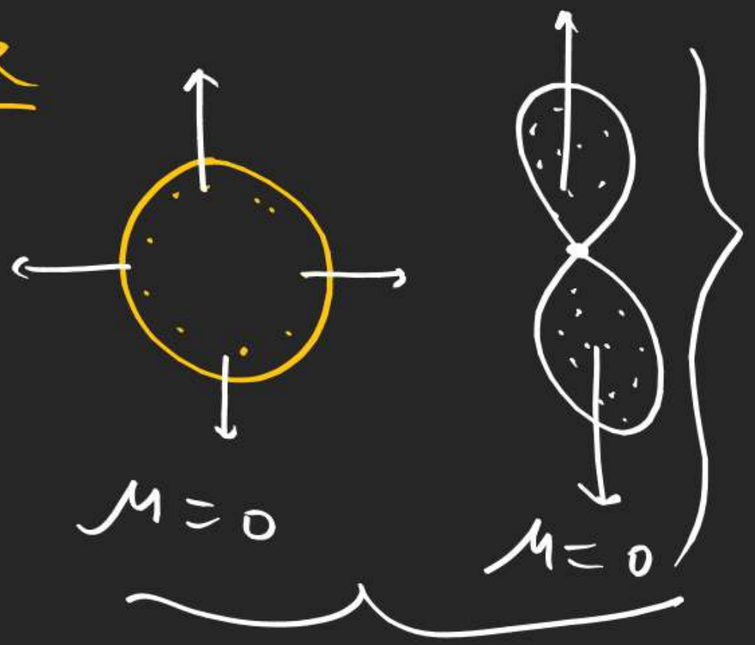
Case-I

l.p present in pure orbital

present in hyb. orbital

Case-II

Case




if l.p present in pure orbital then μ of orbital = 0

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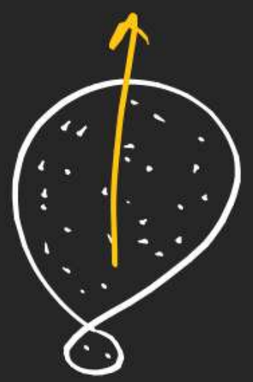

l.p dipole moment away from the central atom.

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