

Isomerism in coordination complexes

```
graph TD; A[Isomerism in coordination complexes] --> B[Structural isomerism]; A --> C[Stereoisomerism]; B --> D[Ionization isomerism]; B --> E[Hydration isomerism]; B --> F[Coordination isomerism]; B --> G[Linkage isomerism]; C --> H[Diastereoisomers]; C --> I[Enantiomers];
```

Structural isomerism

Ionization isomerism
Hydration isomerism
Coordination isomerism
Linkage isomerism

Stereoisomerism

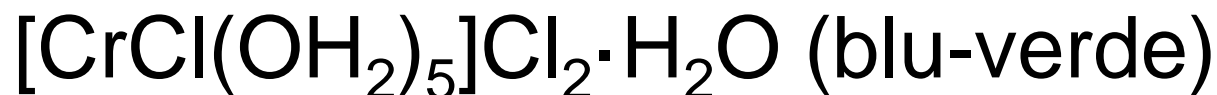
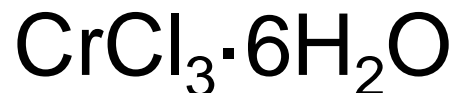
Diastereoisomers
Enantiomers

Isomeri di ionizzazione

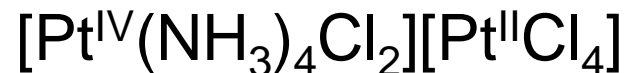
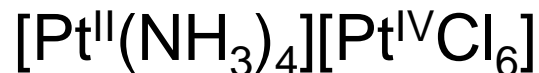
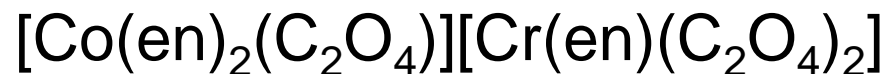
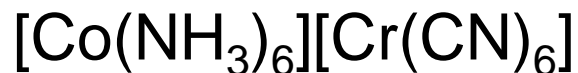
$[\text{CoCl}_2(\text{en})_2]\text{NO}_2$ (verde)
 $[\text{Co}(\text{NH}_3)_5\text{Br}](\text{SO}_4)$ (violetto)

$[\text{CoCl}(\text{NO}_2)(\text{en})_2]\text{Cl}$ (rosso)
 $[\text{Co}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$ (rosso)

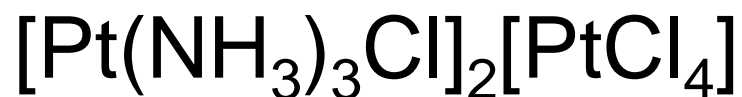
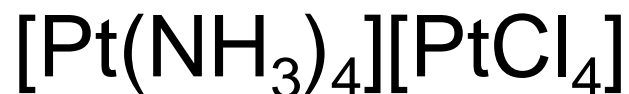
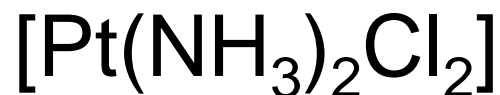
Isomeri di idratazione



Isomeri di coordinazione



Isomeri di polimerizzazione



Isomeri di legame (leganti ambidentati)

–NO₂ (nitro)

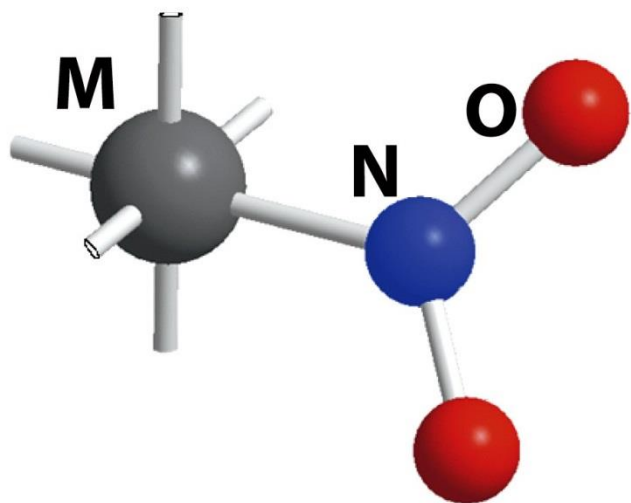
–C≡N (nitrile)

–S–C≡N[–] (tiocianato)

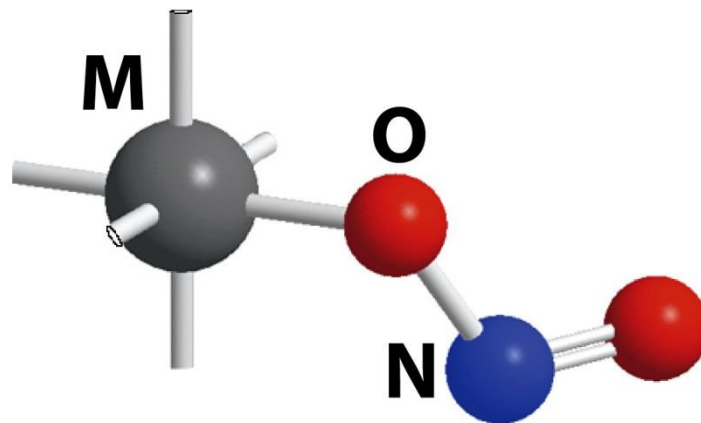
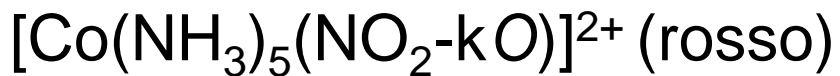
–O–NO (nitrito)

–N≡C (isonitrile)

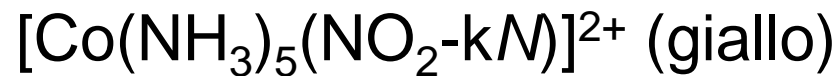
–N=C=S[–] (isotiocianato)

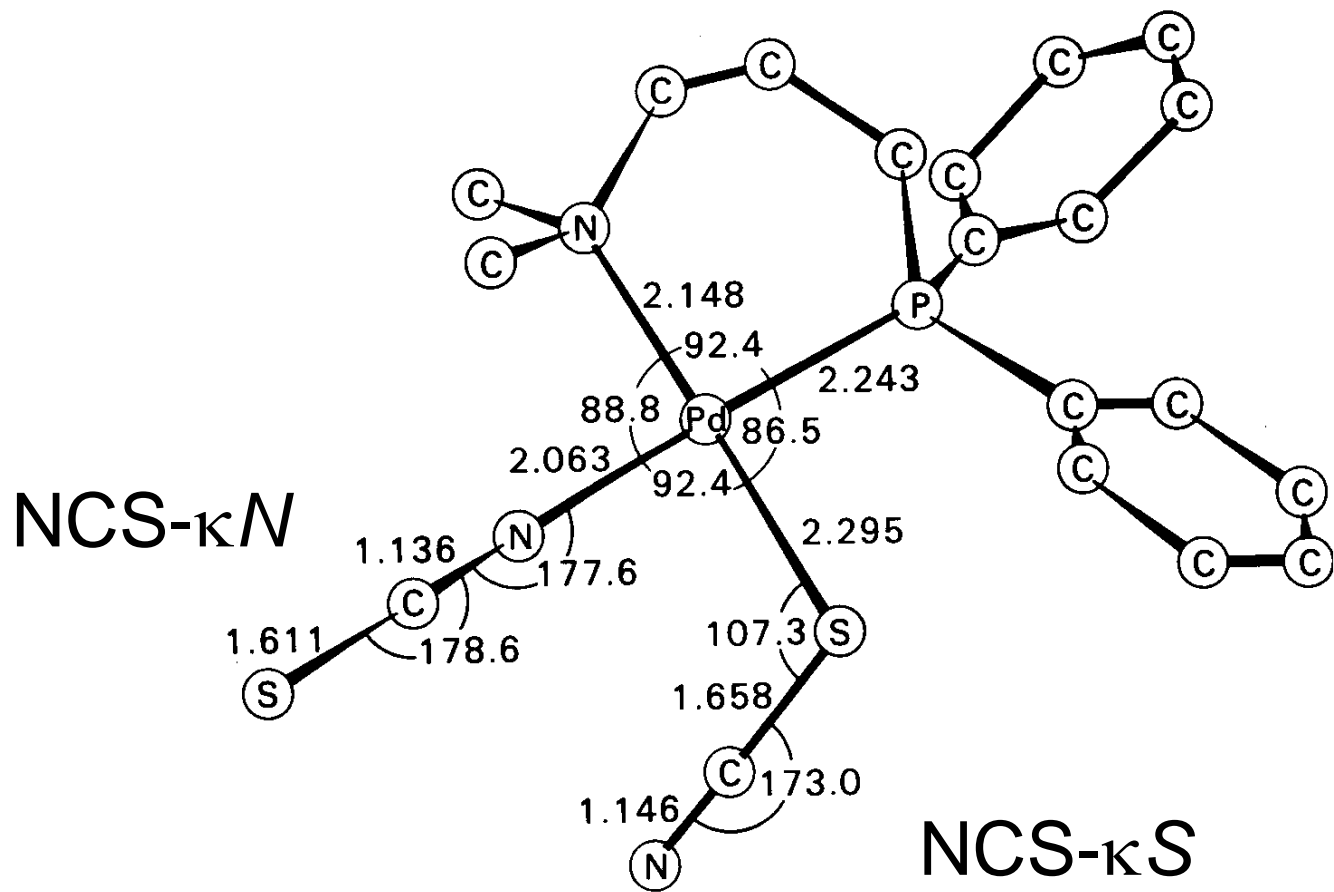


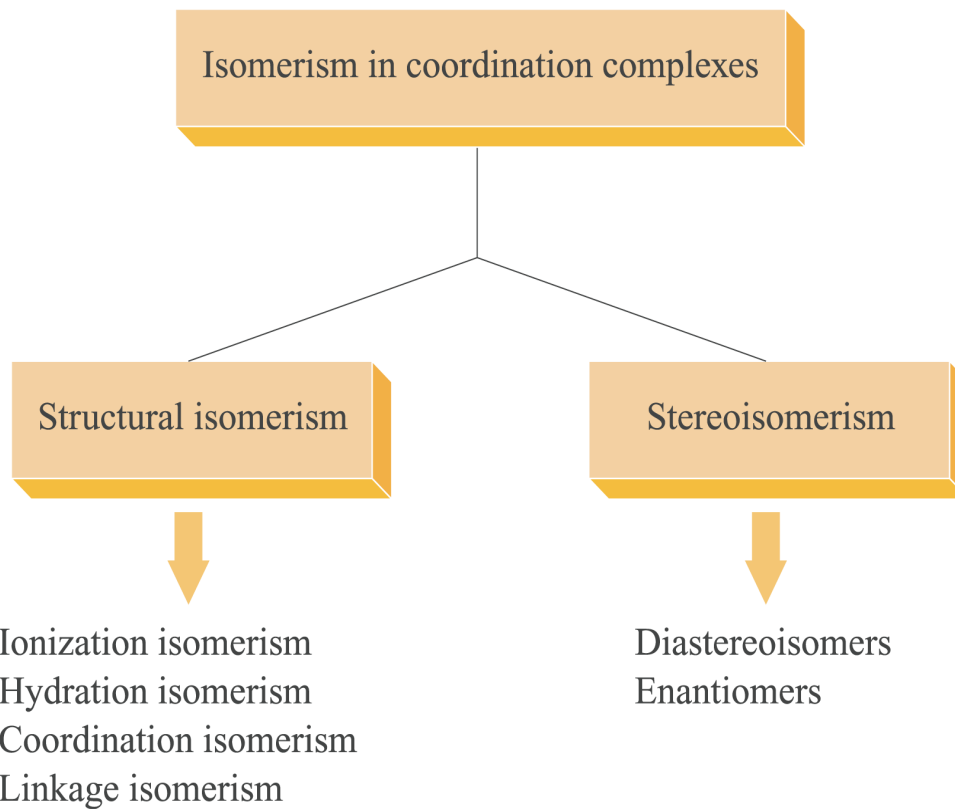
Nitro ligand



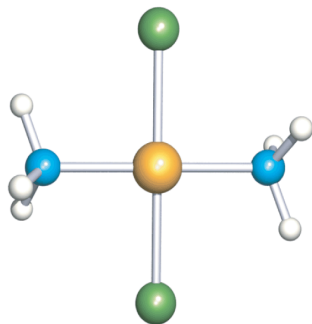
Nitrito ligand



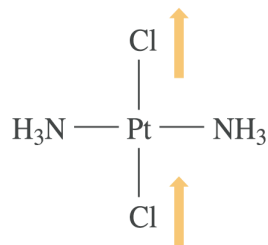




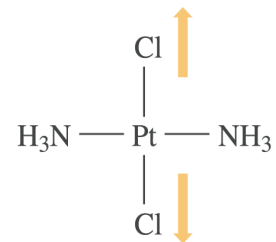
stereoisomeri che non siano enantiomeri sono diastereoisomeri



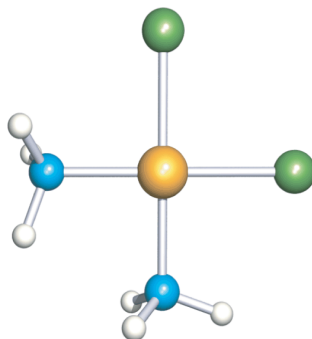
The *trans*-isomer is non-polar



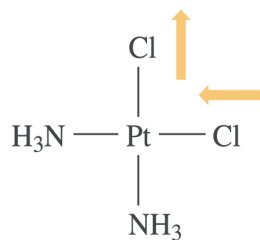
Asymmetric stretch:
IR active
 365 cm^{-1}



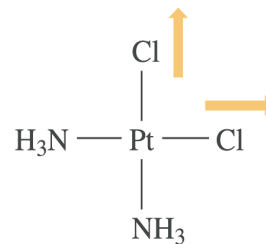
Symmetric stretch:
IR inactive



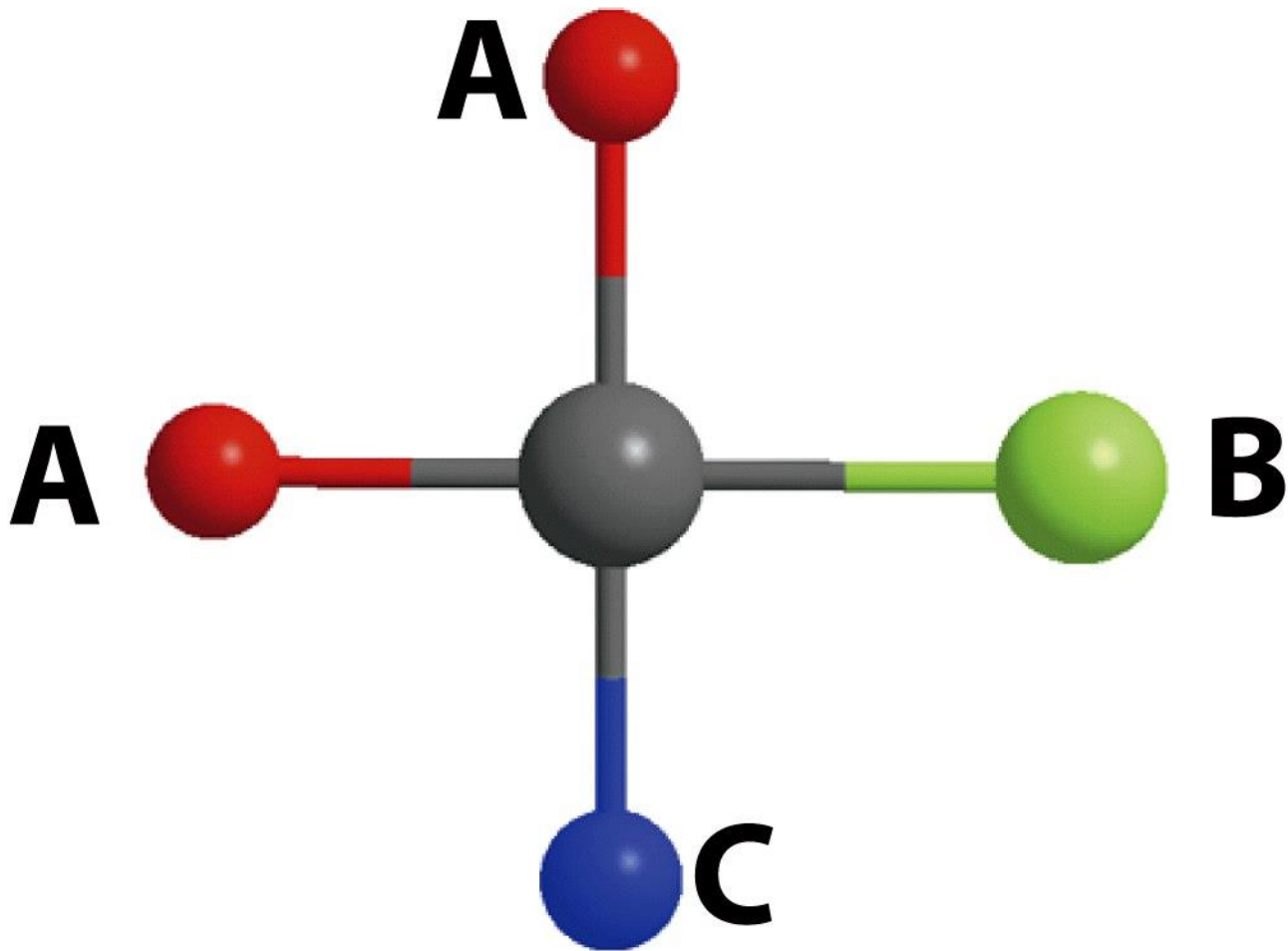
The *cis*-isomer is polar



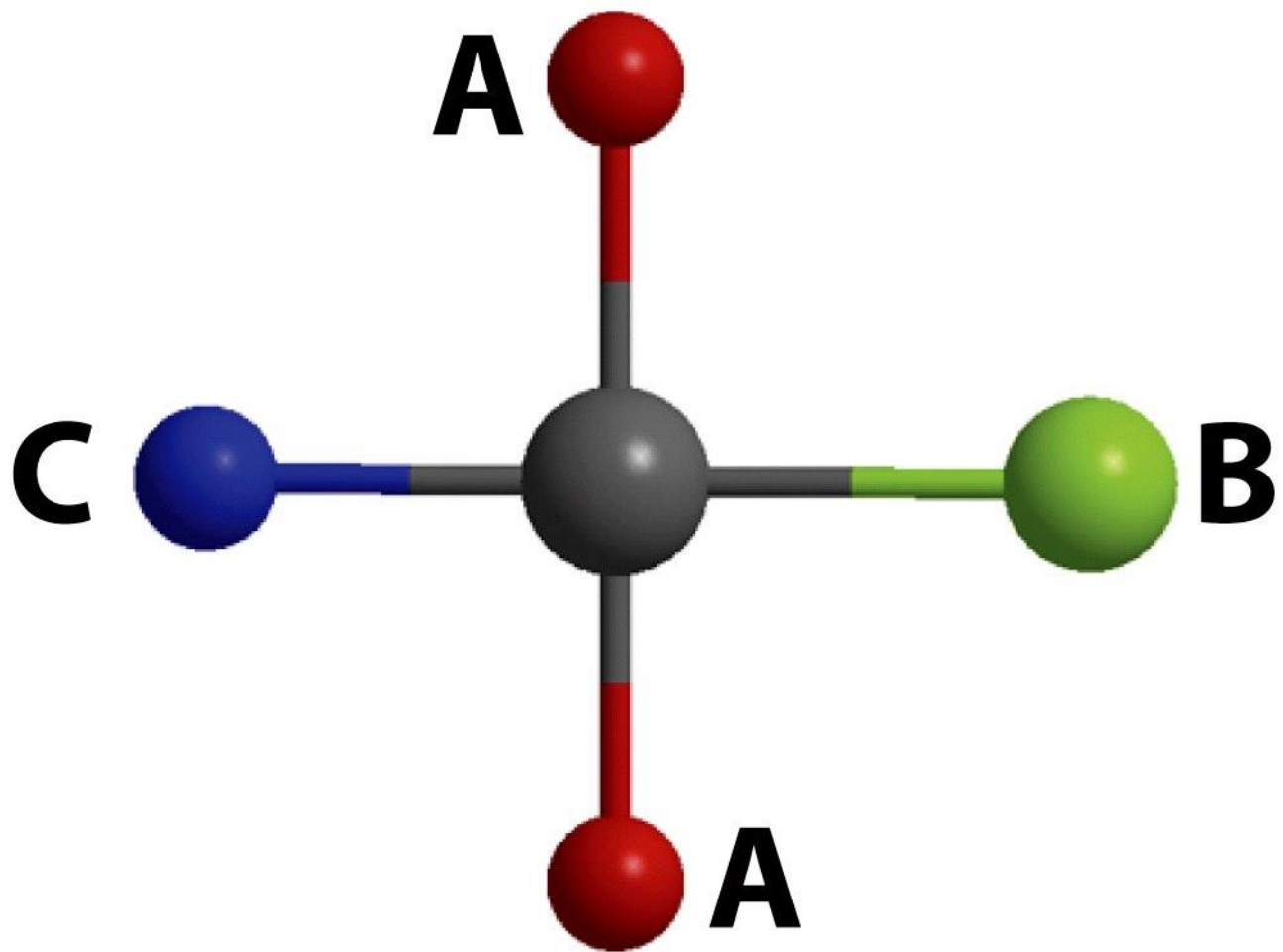
Asymmetric stretch:
IR active
 330 cm^{-1}



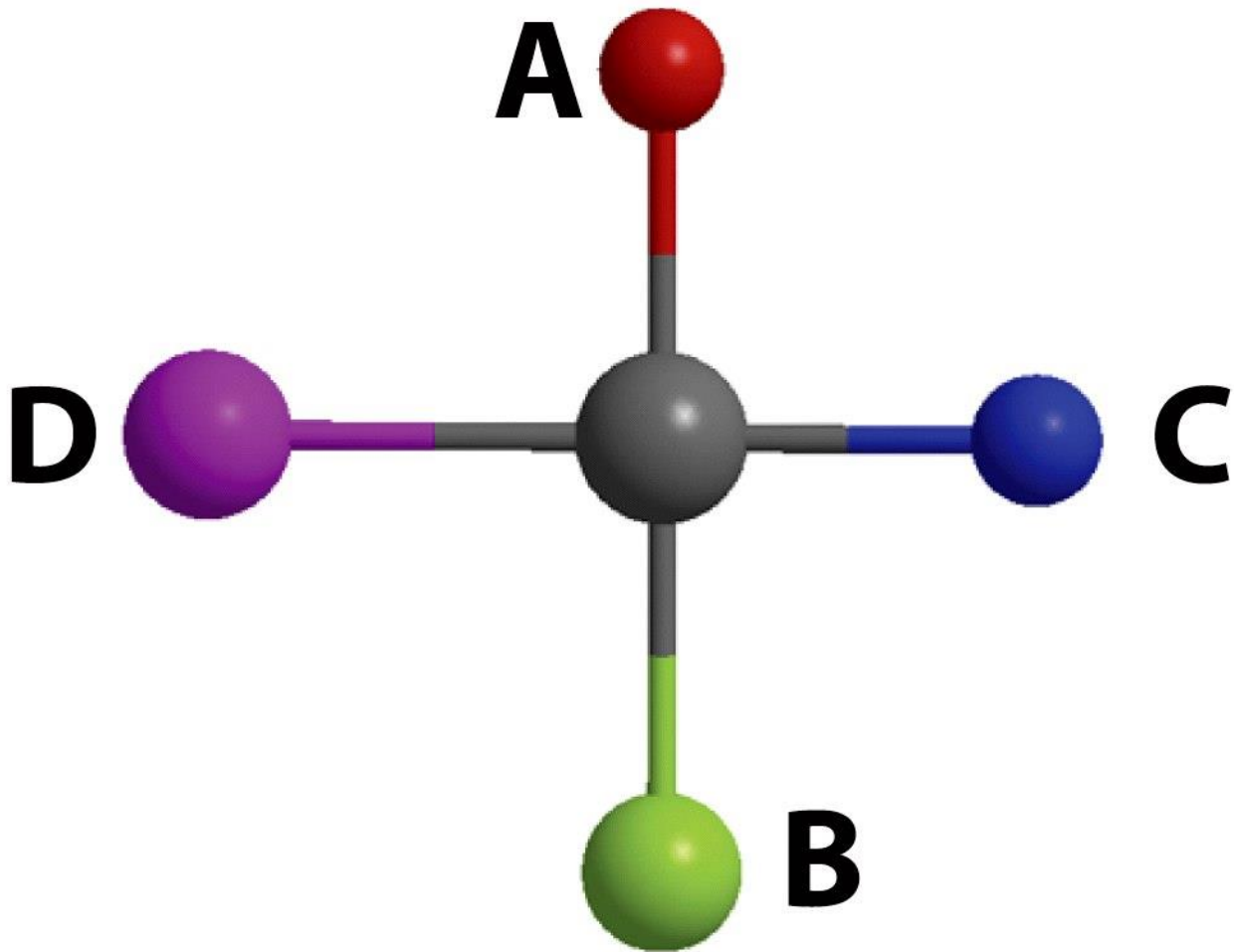
Symmetric stretch:
IR active
 323 cm^{-1}



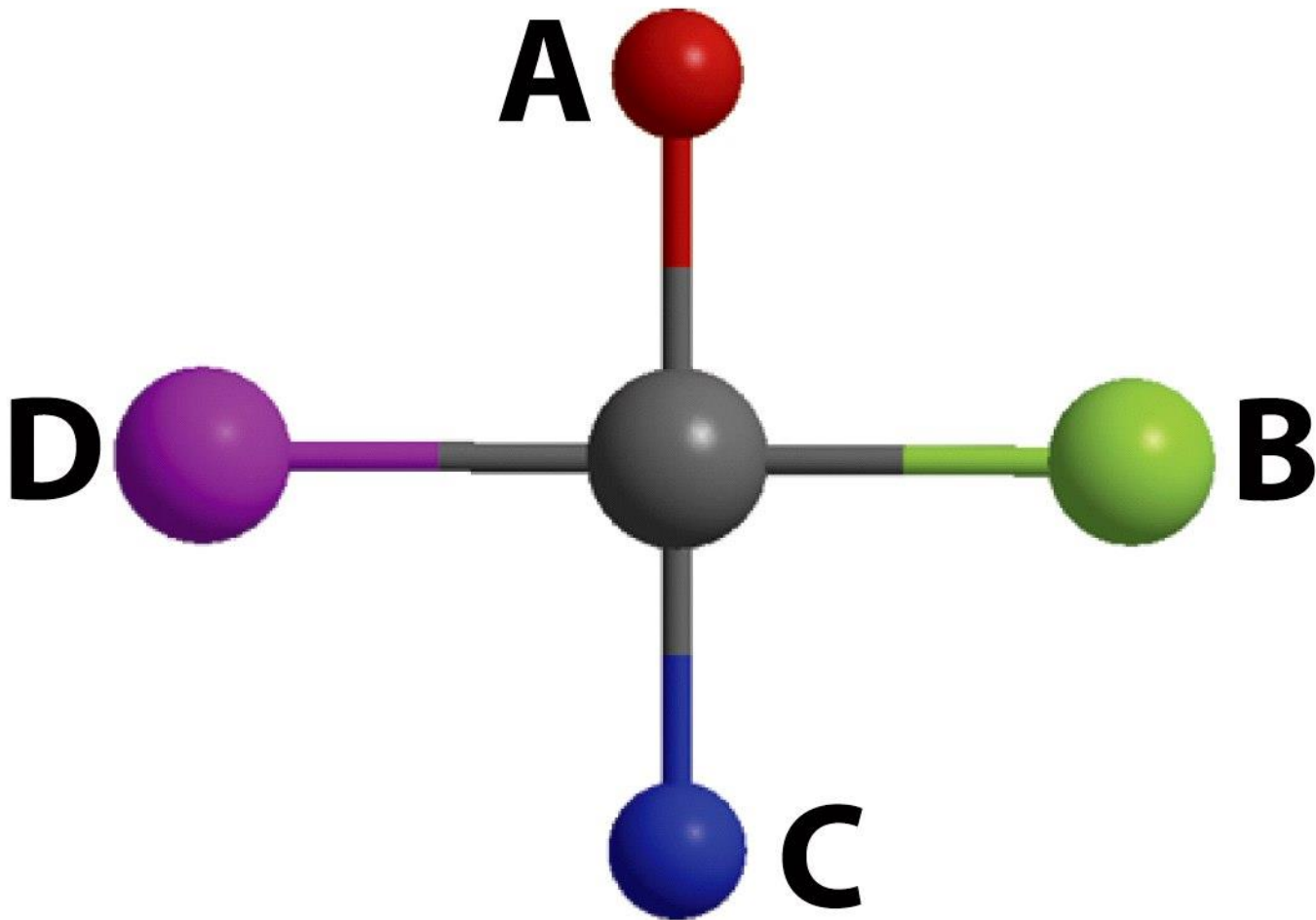
***cis*-[MA₂BC]**



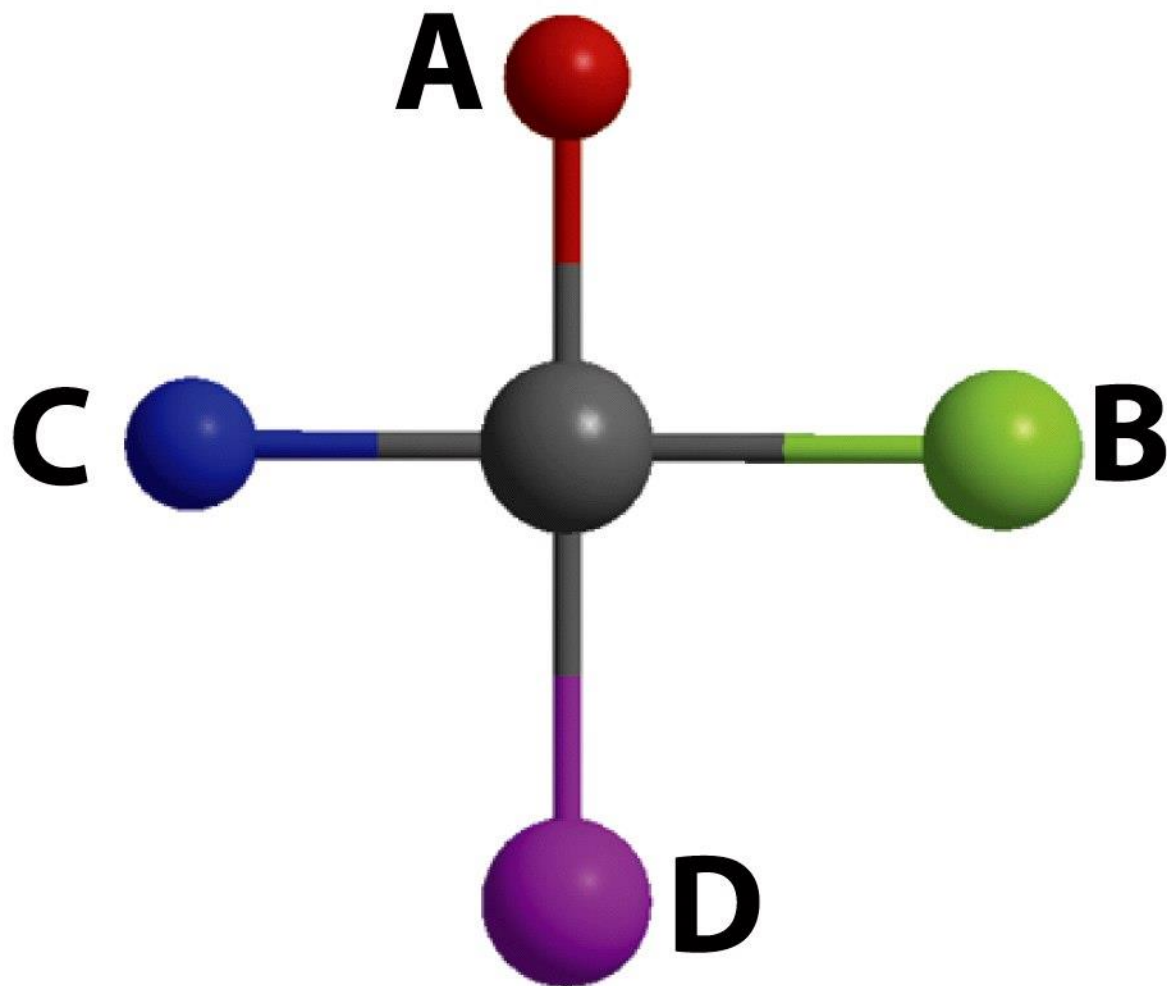
***trans*-[MA₂BC]**



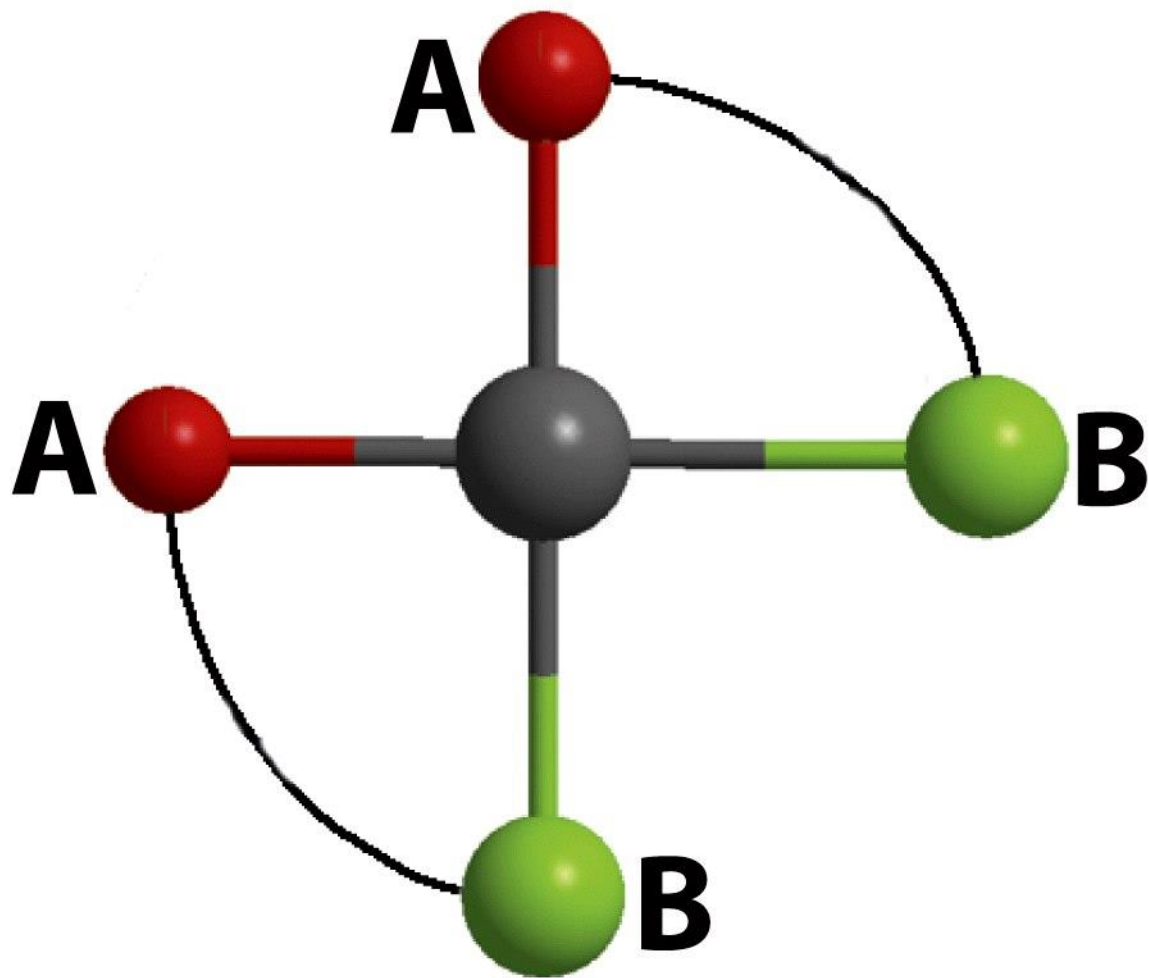
[MABCD], A *trans* to B

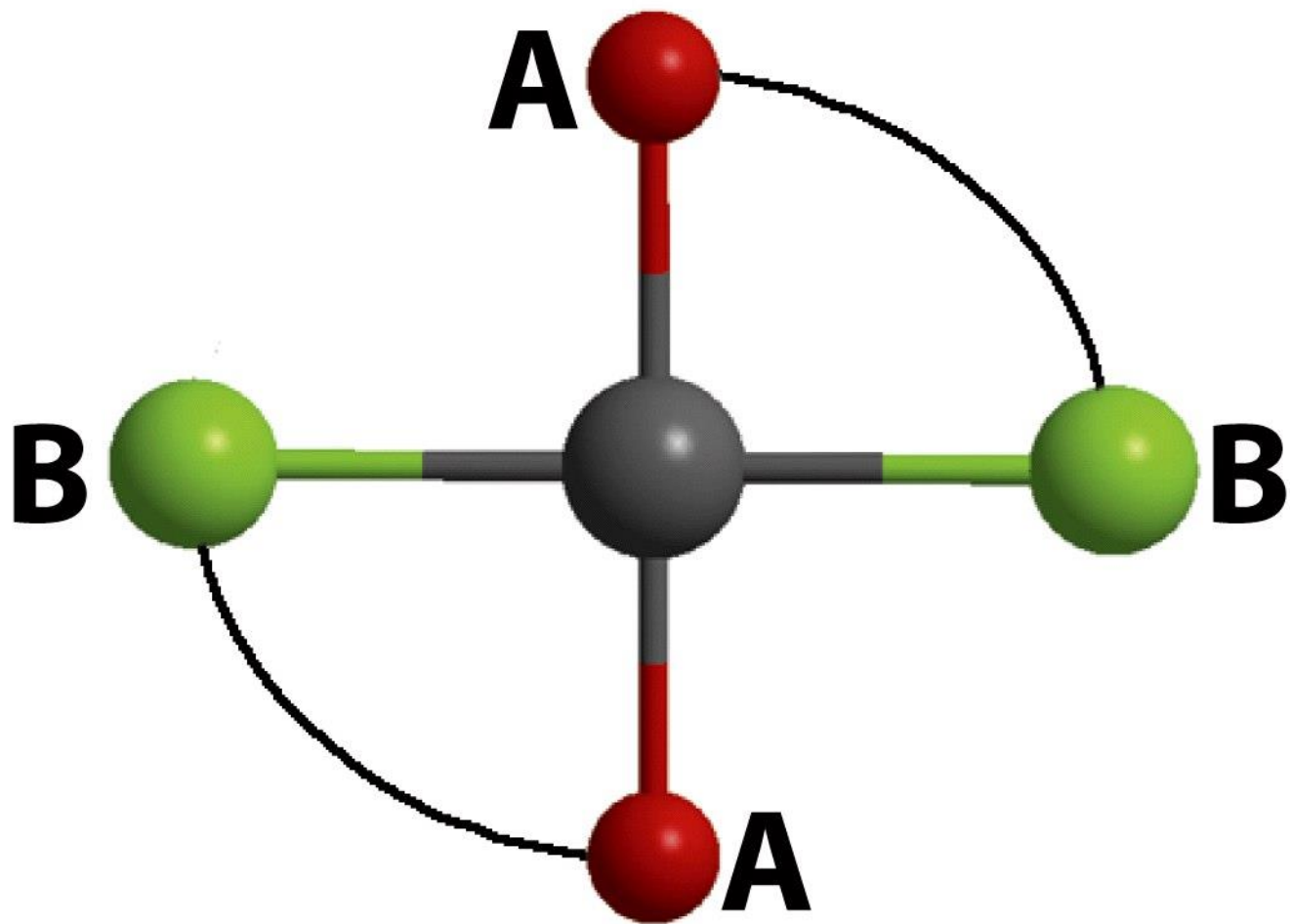


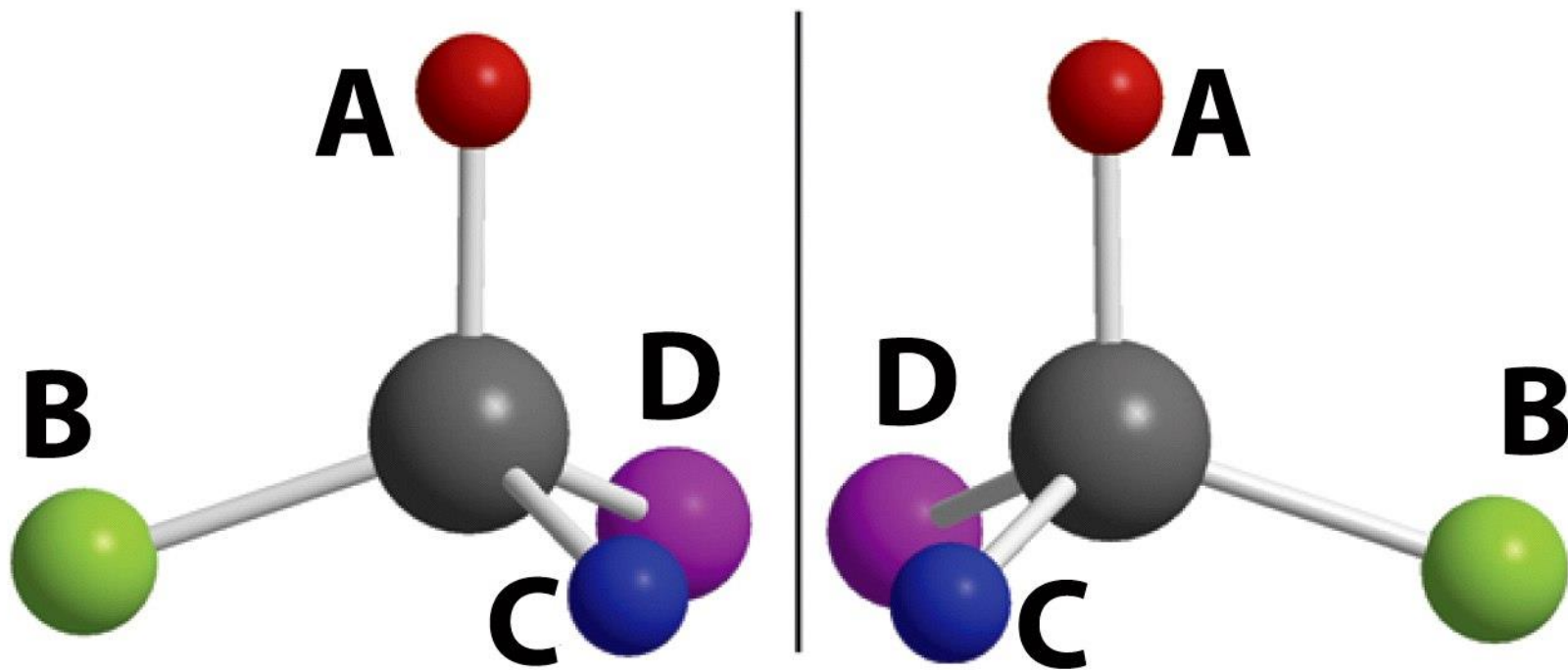
[MABCD], *A trans to C*



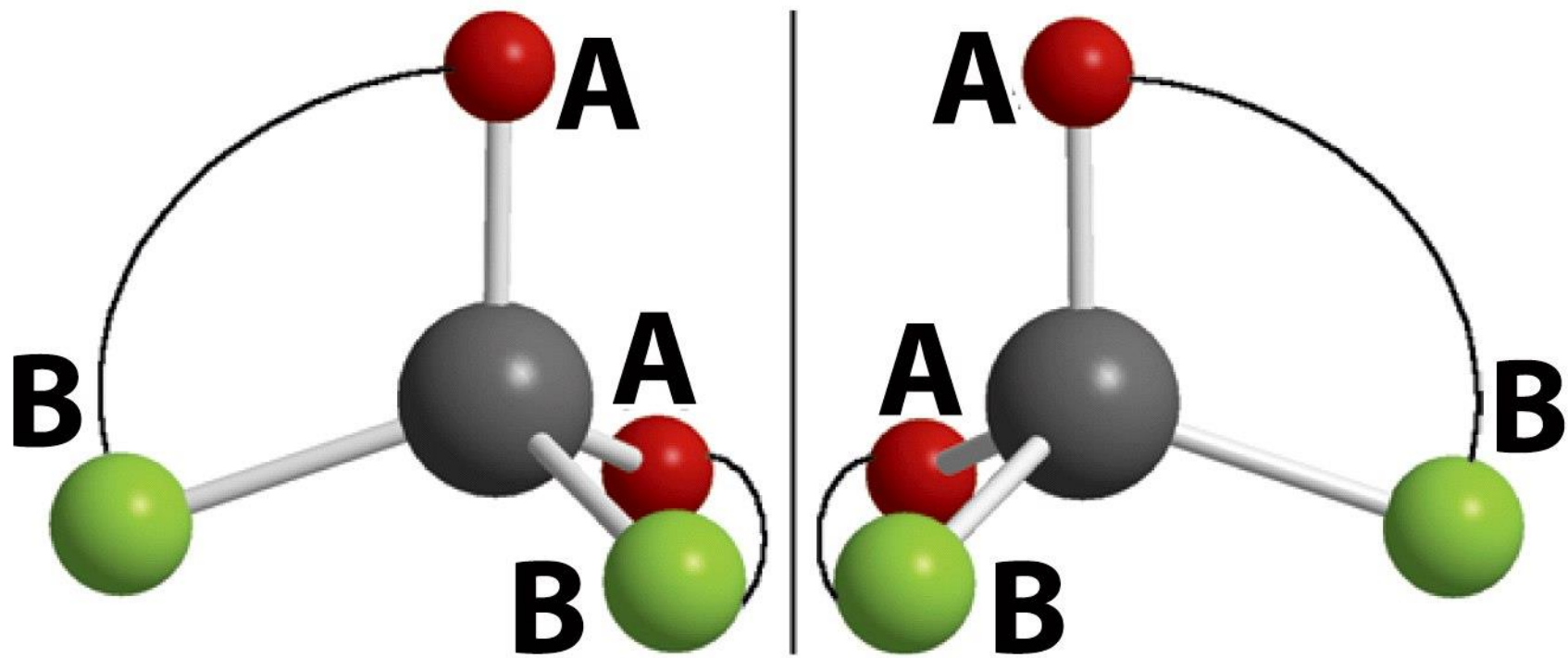
[MABCD], *A trans to D*



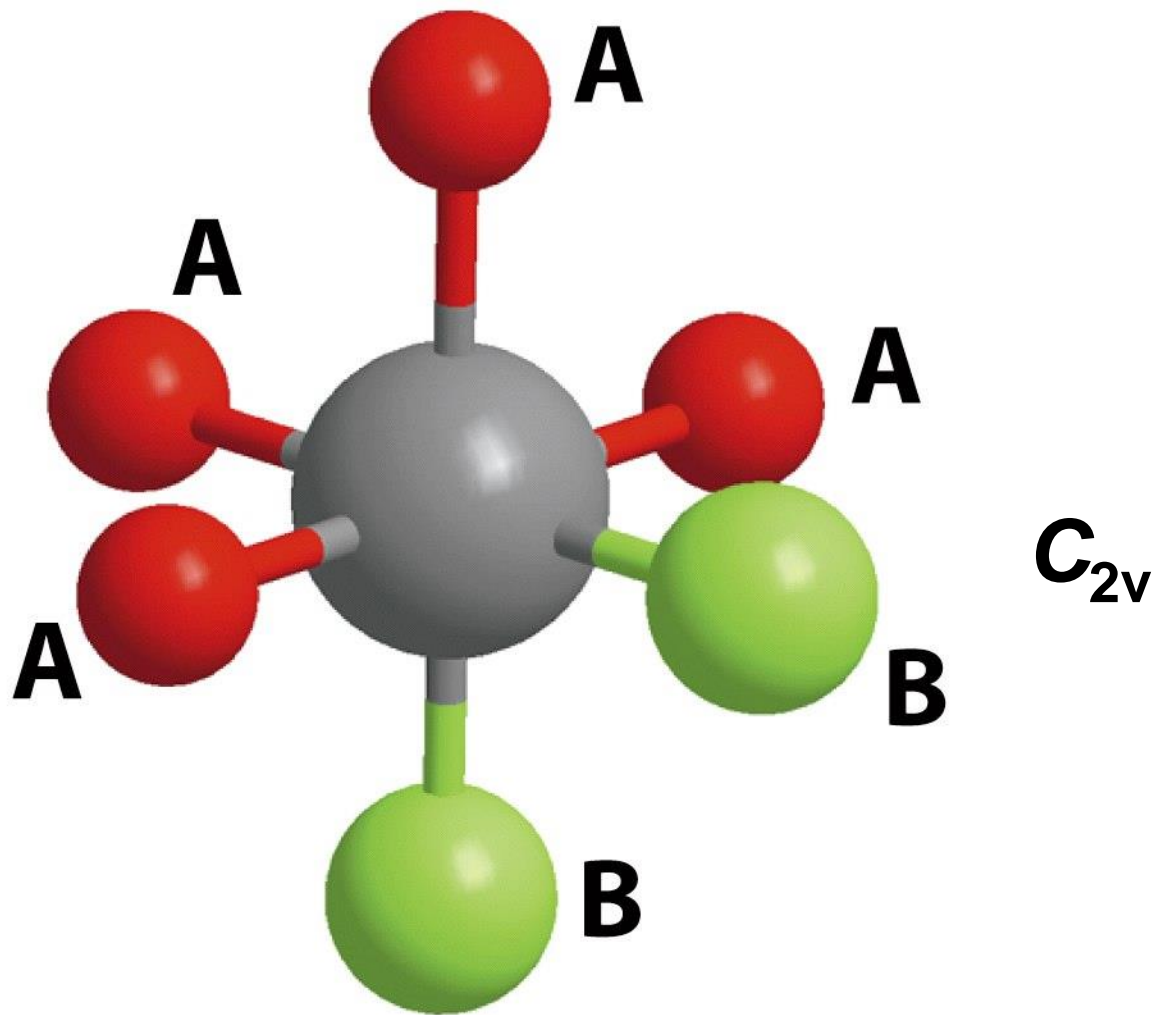


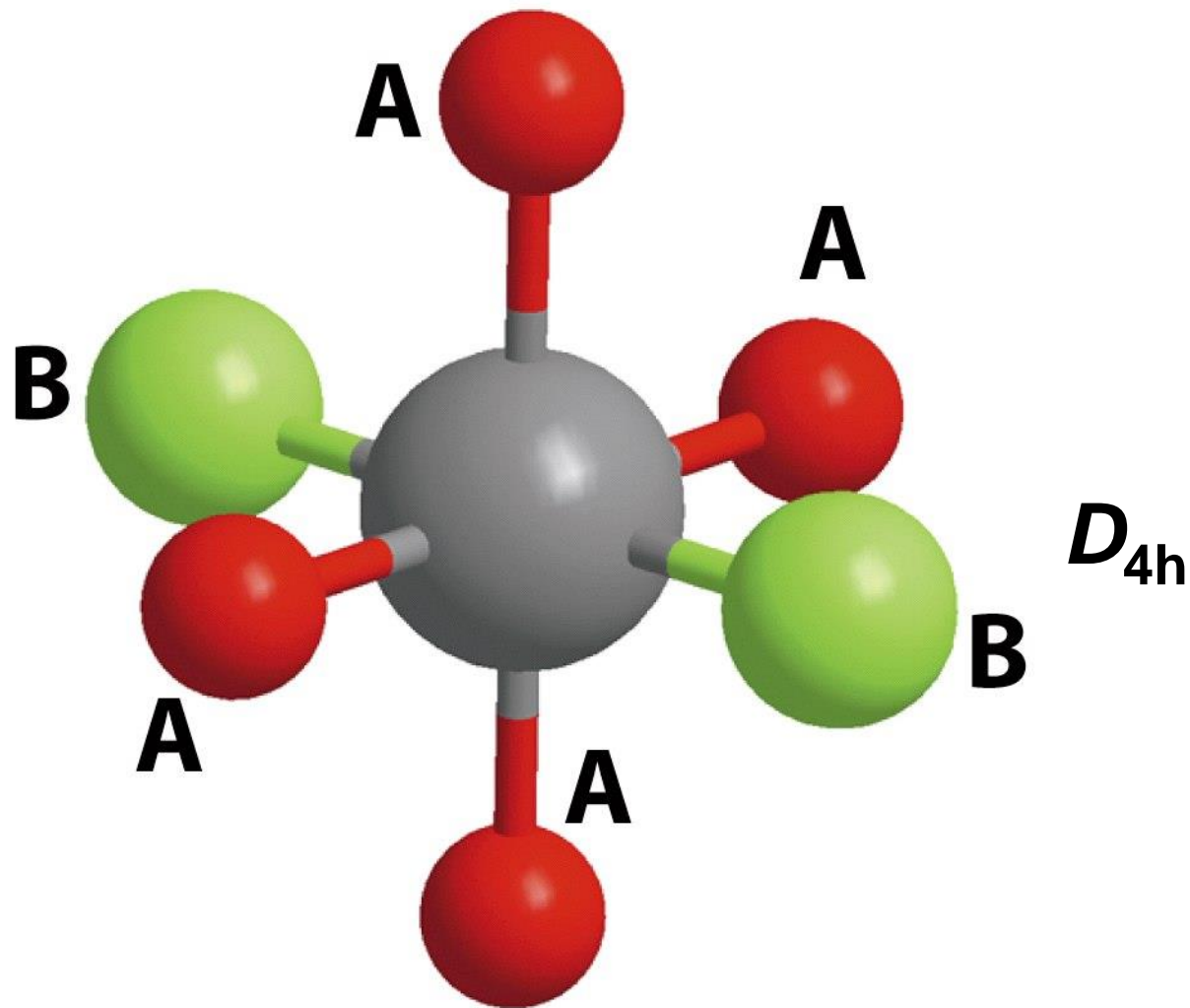


[MABCD] enantiomers

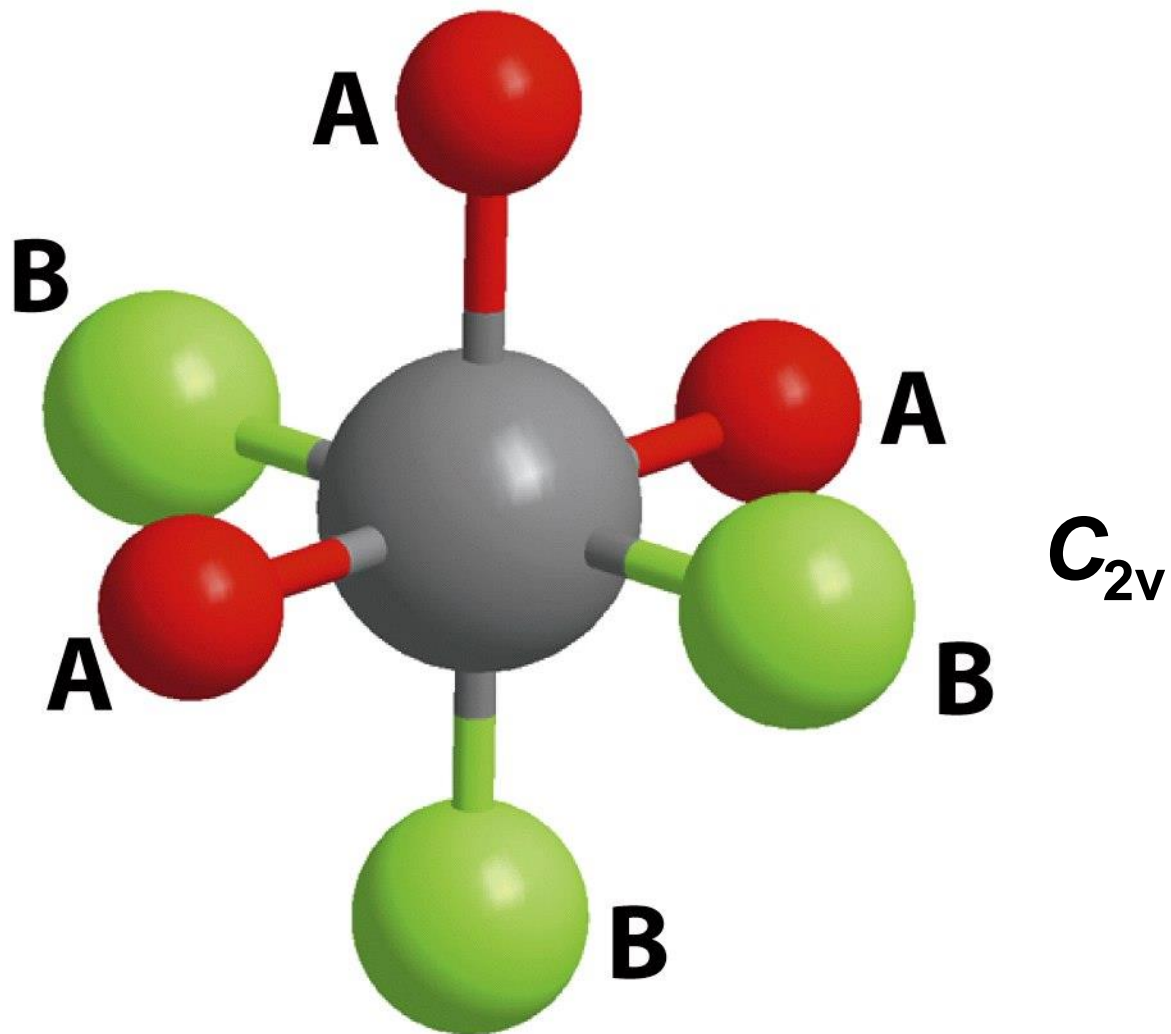


$[M(AB)_2]$ enantiomers

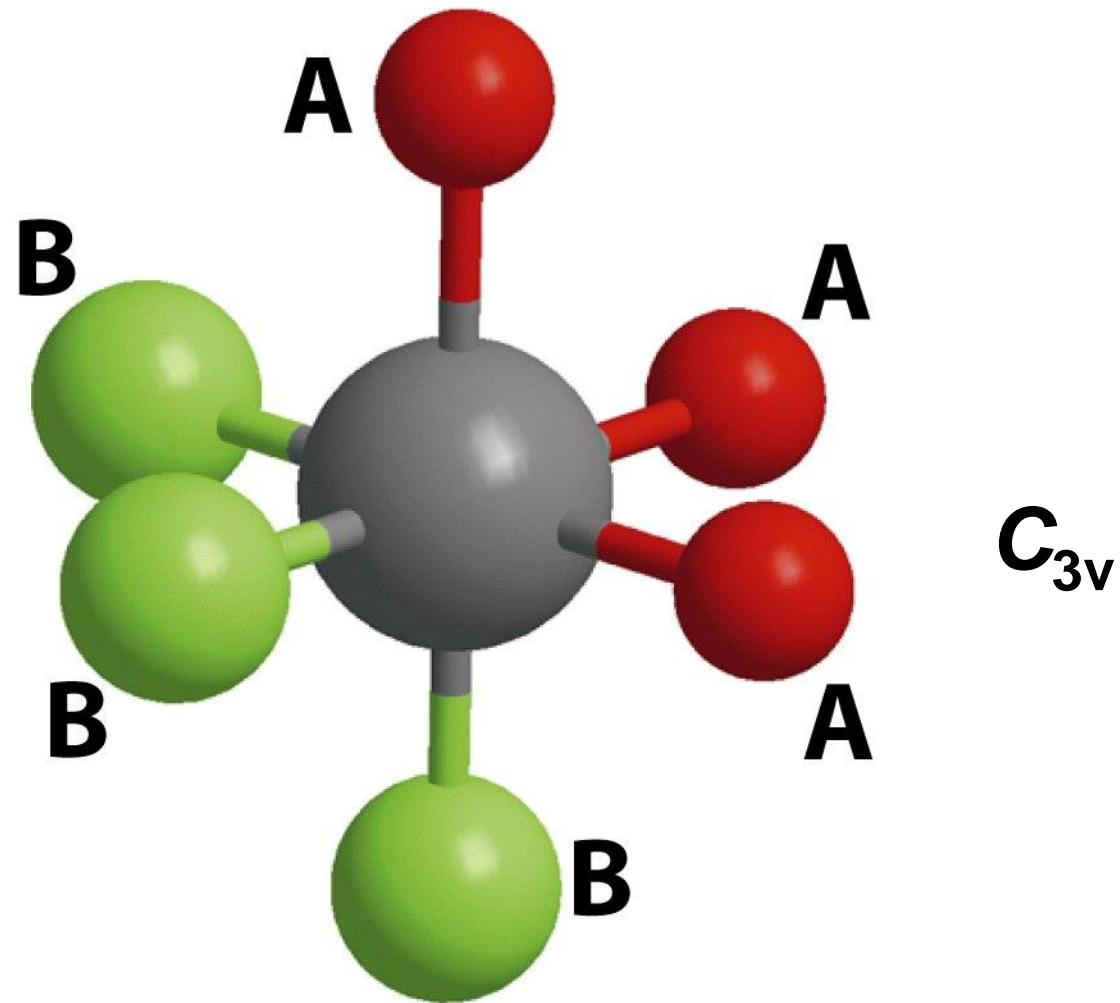




***trans*-[MA₄B₂]**

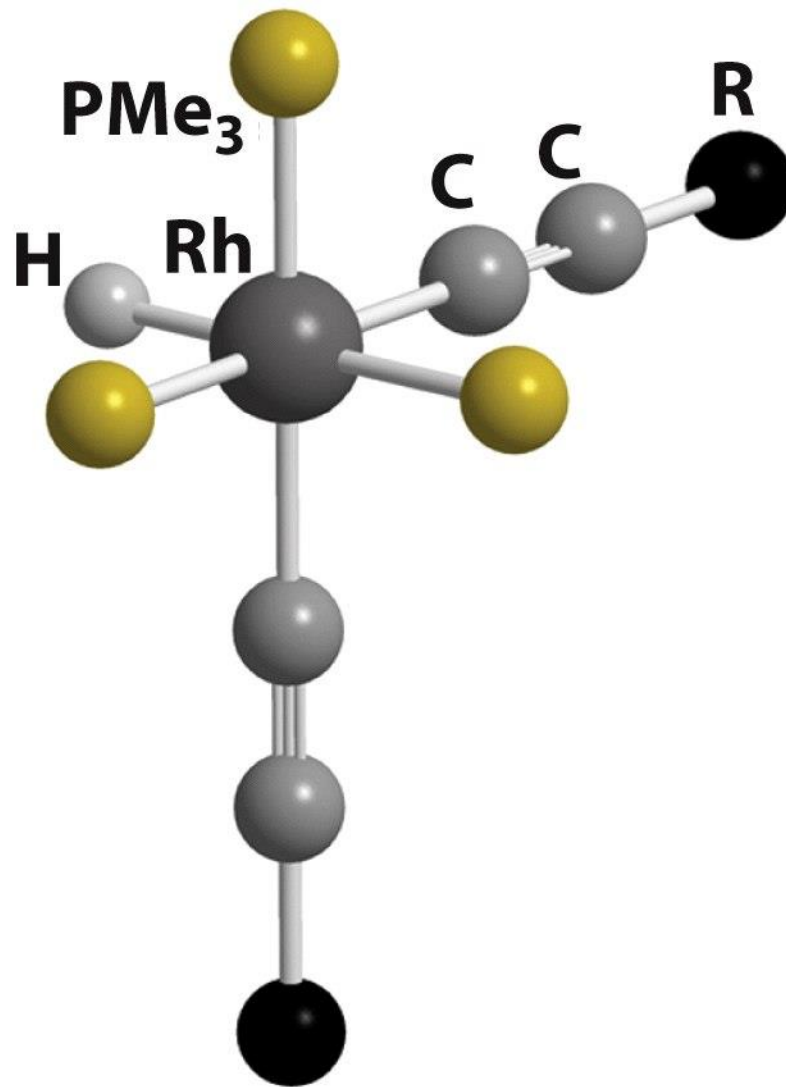


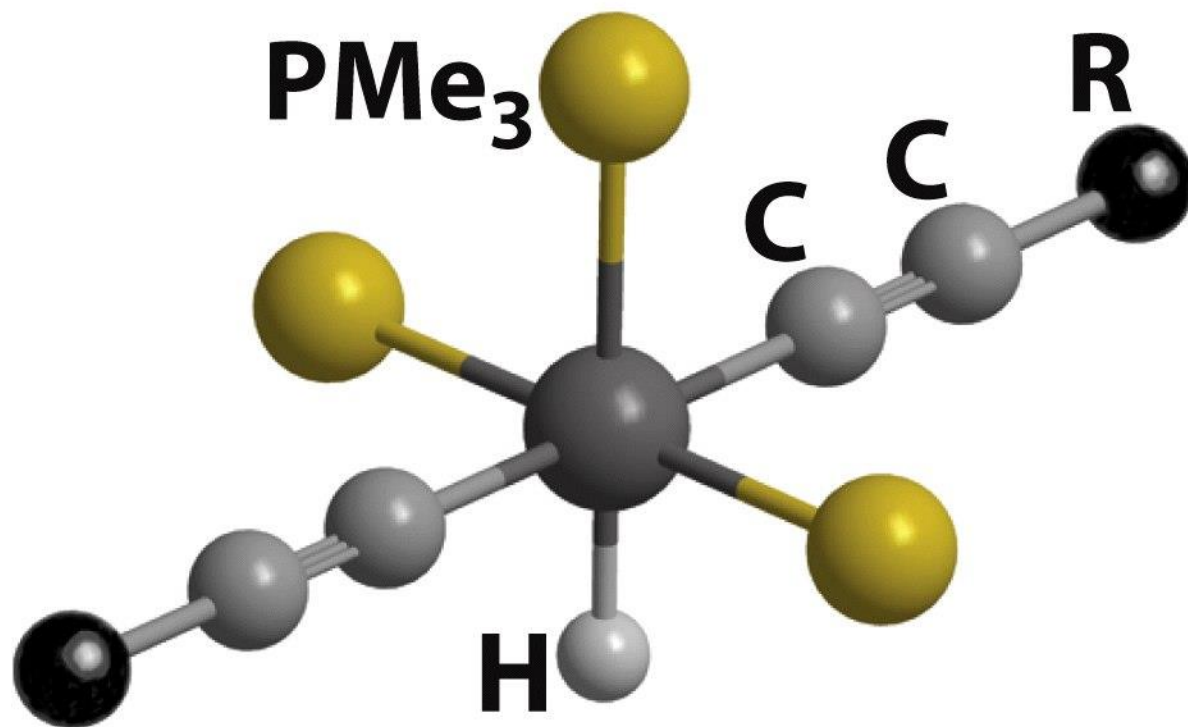
meridional

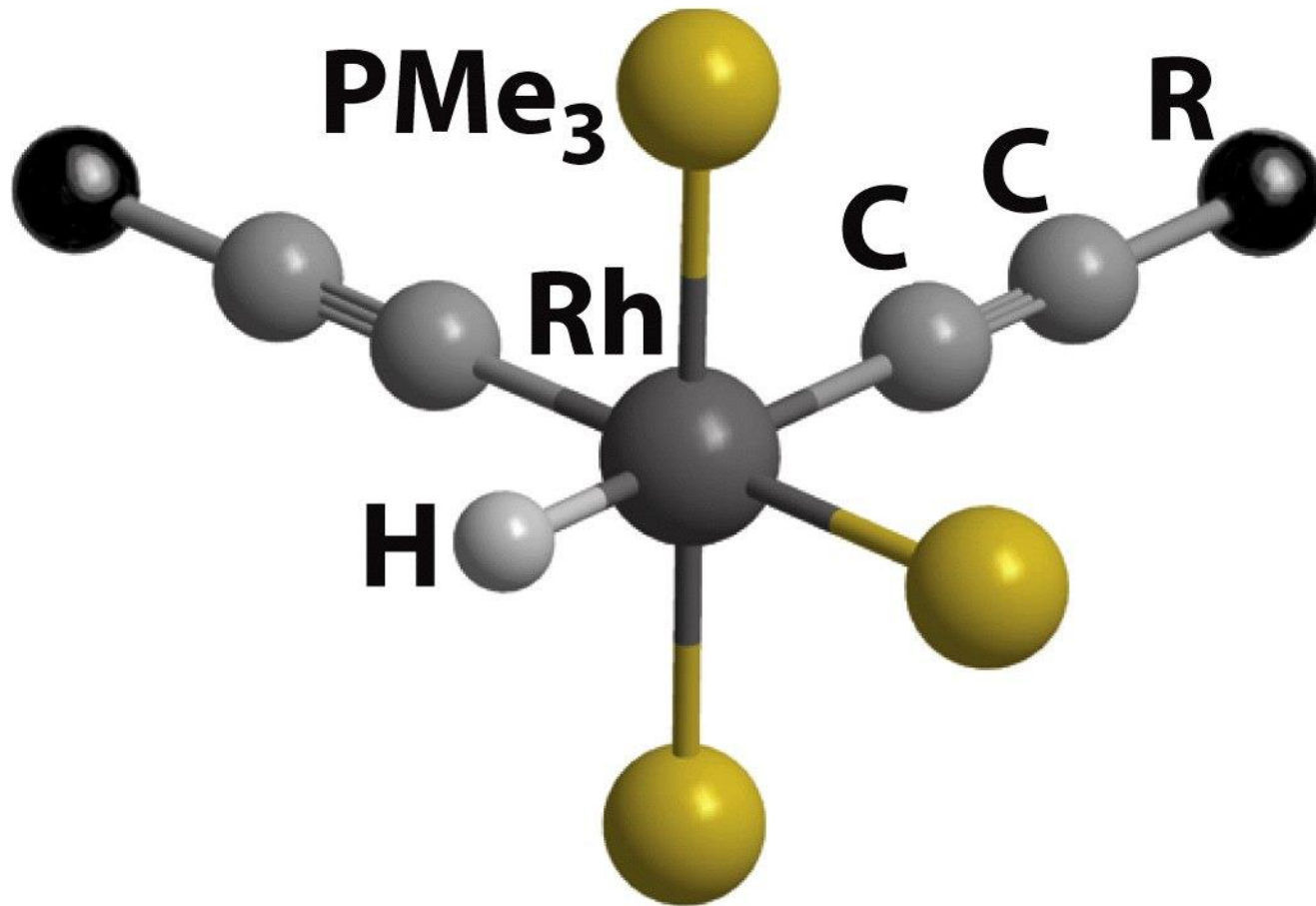


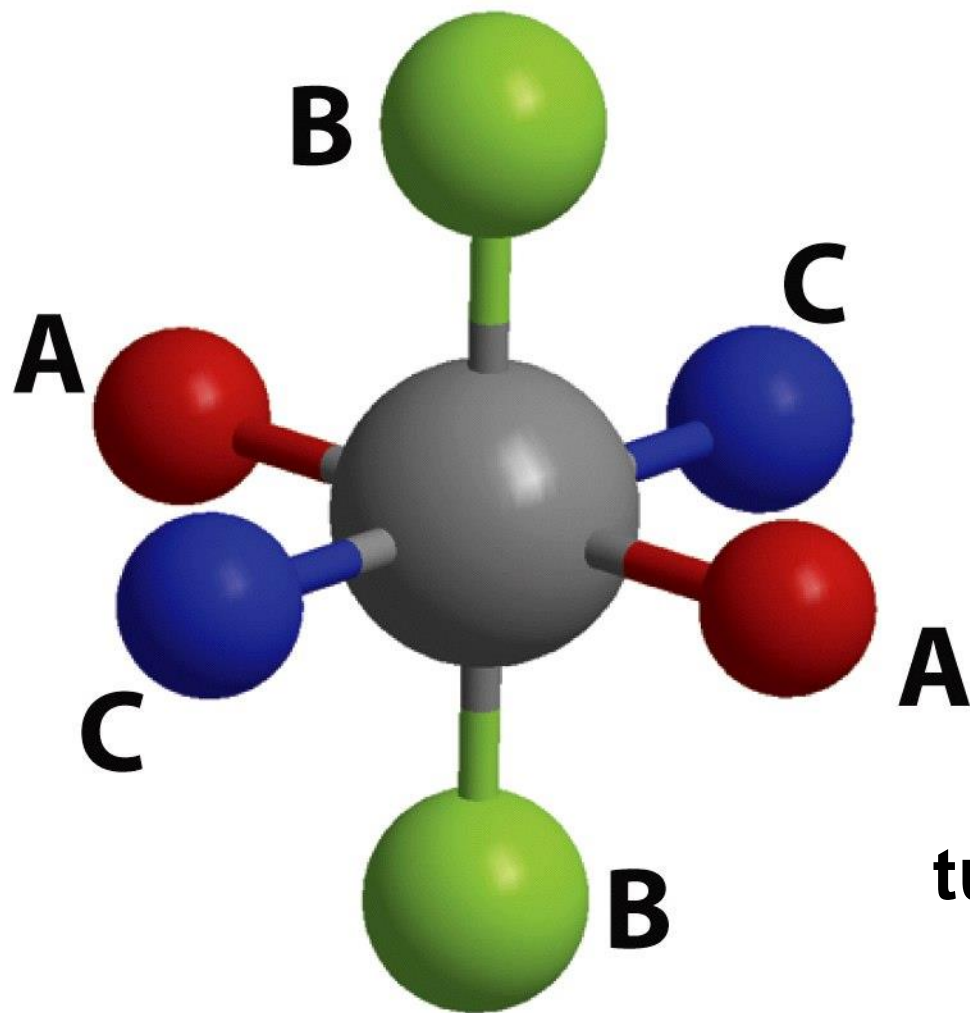
fac-[MA₃B₃]

facial



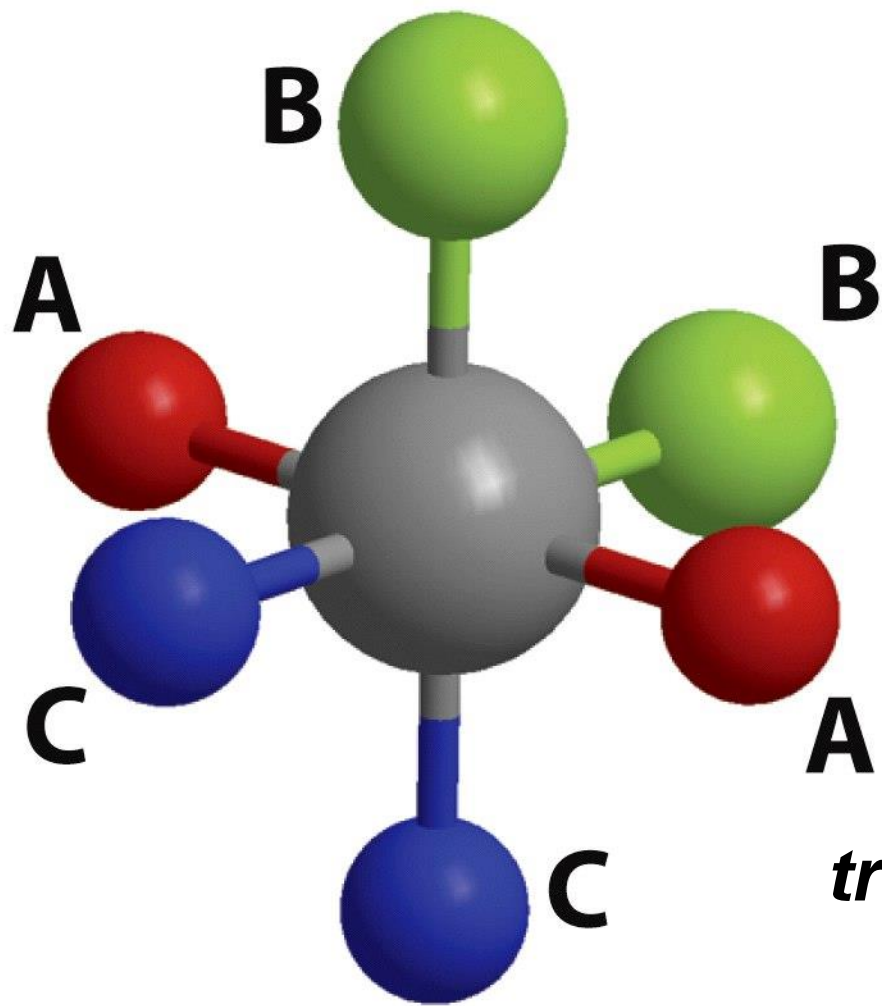






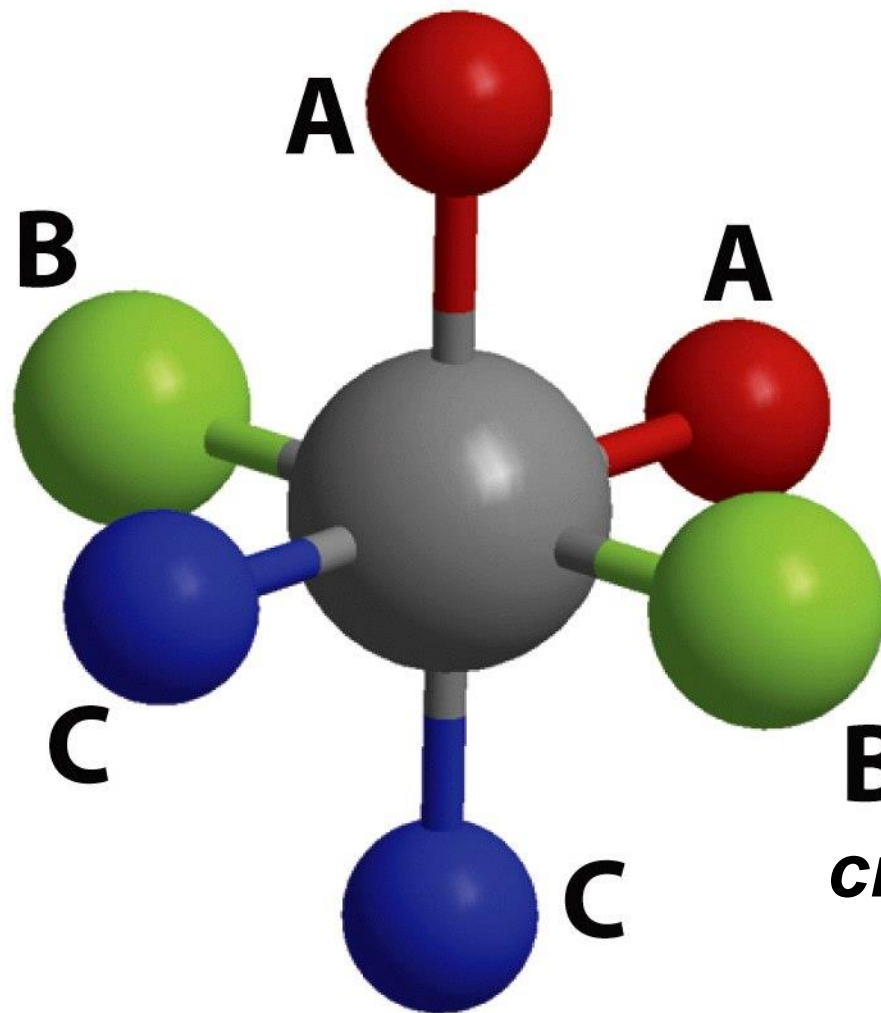
tutto-trans





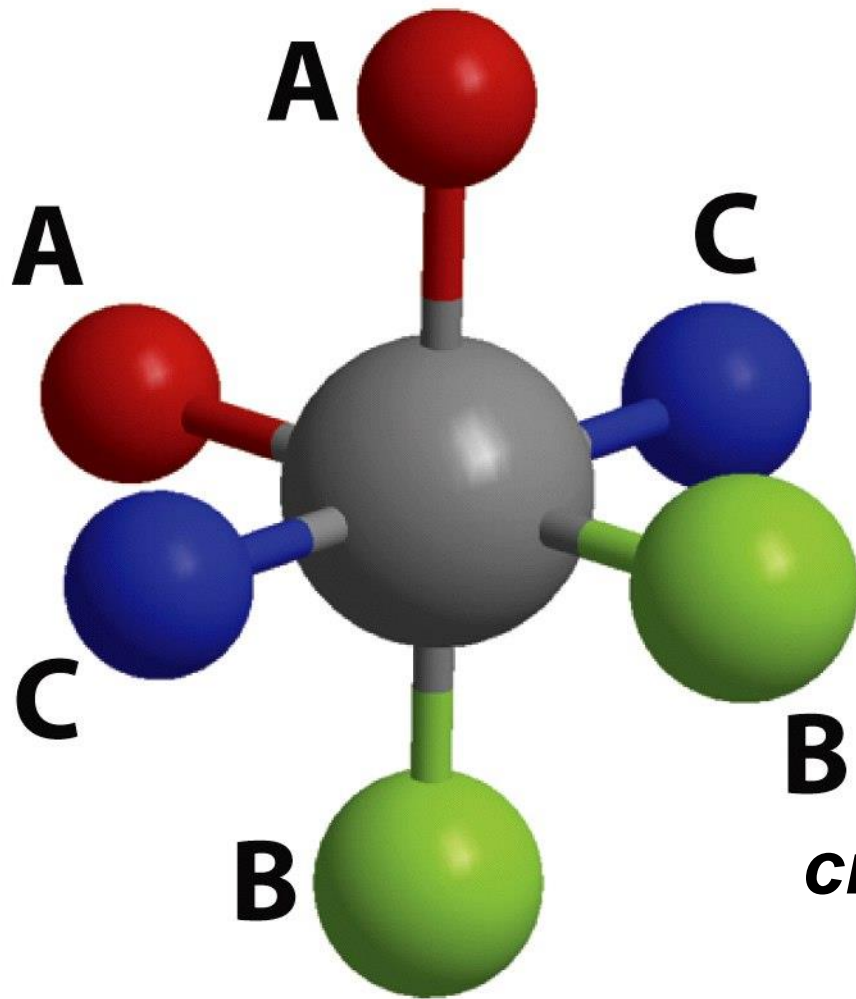
trans, cis, cis





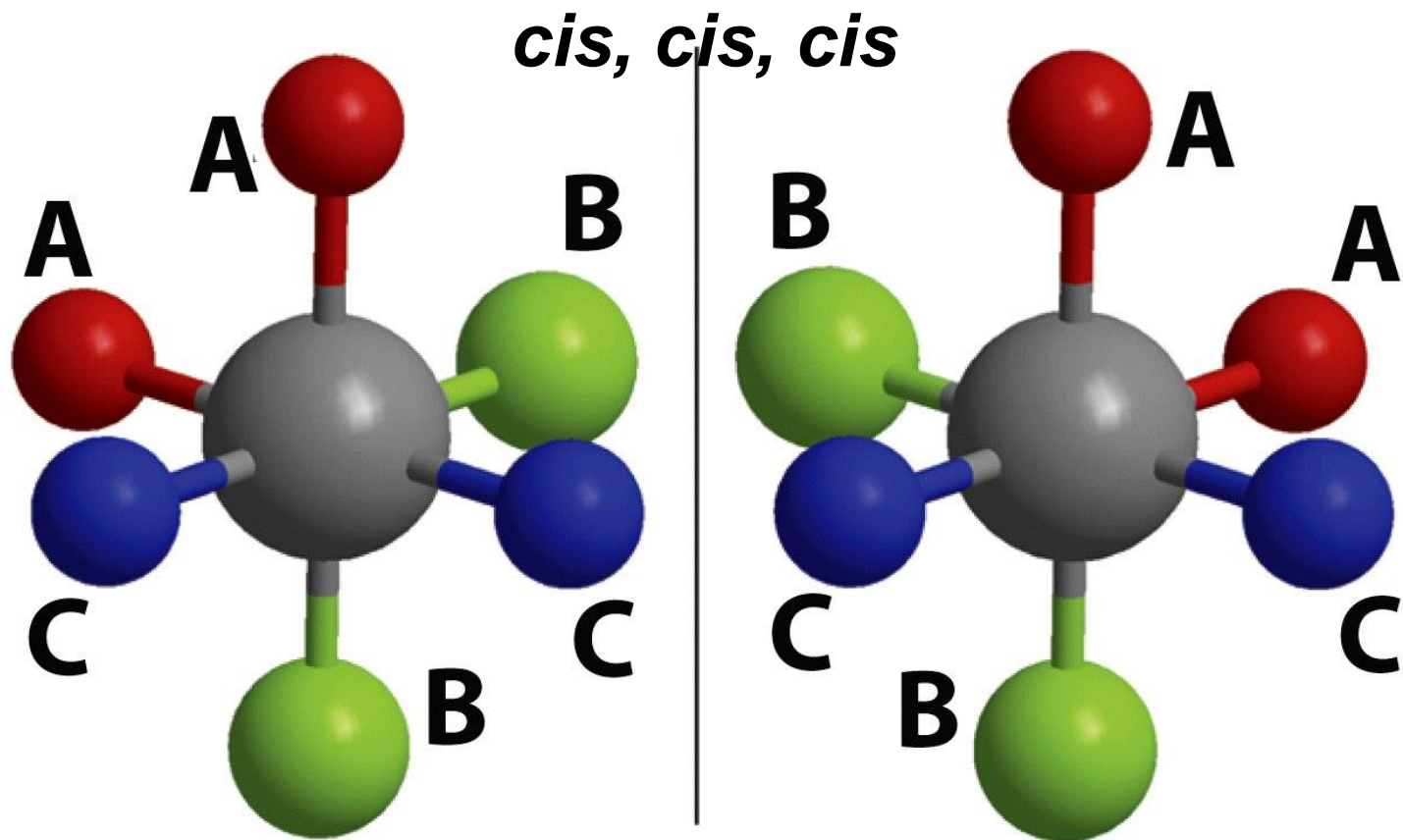
cis, trans, cis





cis, cis, trans



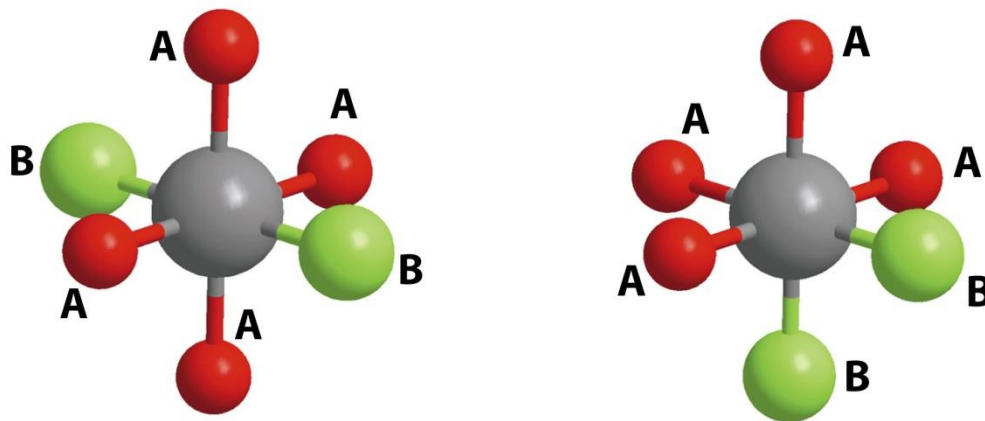


[MA₂B₂C₂] enantiomers

M = centro stereogenico

Descrittori A e C

*Un atomo di una molecola viene detto **stereogenico** se uno scambio di due leganti porta ad uno stereoisomero della molecola di partenza.*

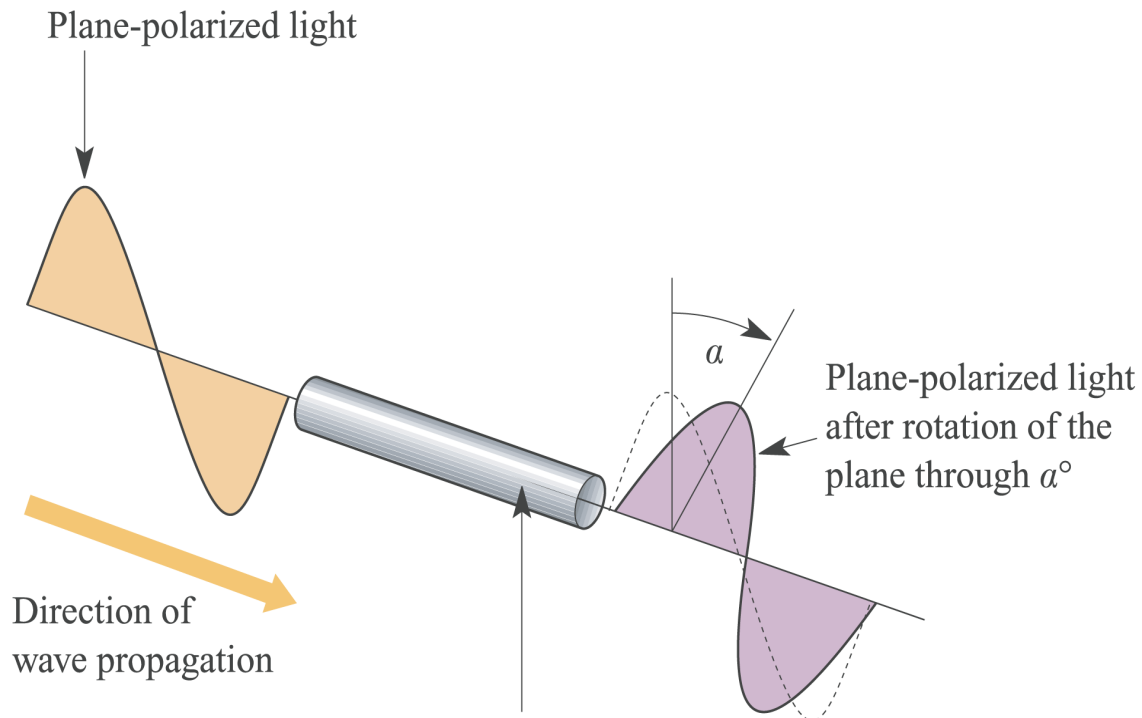


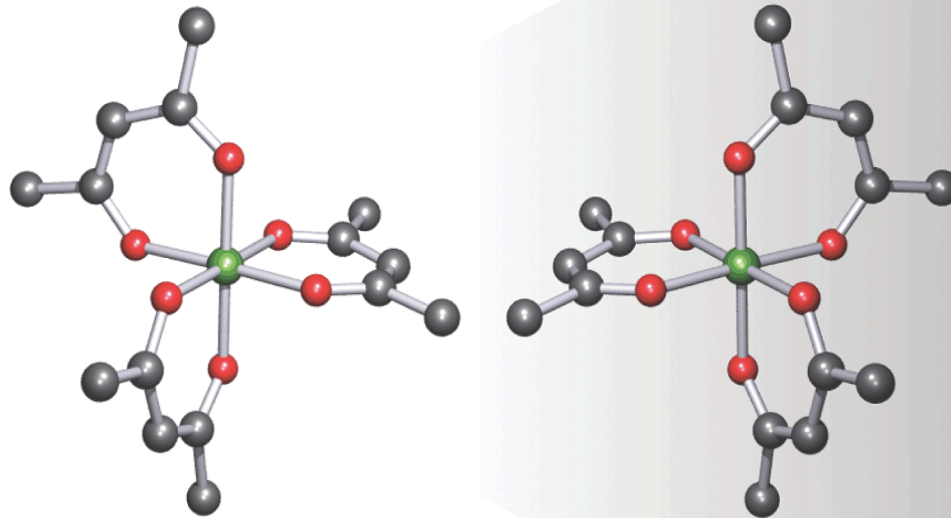
M = centro stereogenico non-chirale

Enantiomeri

- *in un ambiente achirale gli enantiomeri si comportano allo stesso modo;*
- *in un ambiente chirale non racemico (e.g. ambiente biologico) gli enantiomeri si comportano in modo diverso*

in un ambiente chirale ma racemico gli enantiomeri danno segno opposto per certe grandezze osservabili

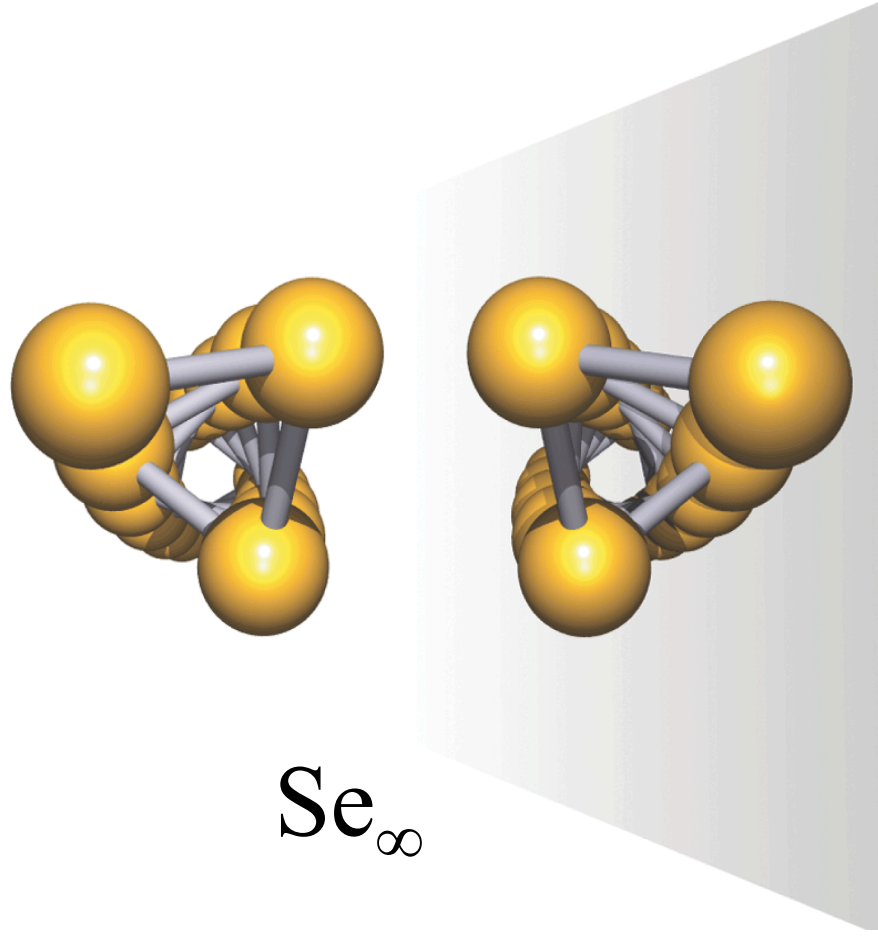




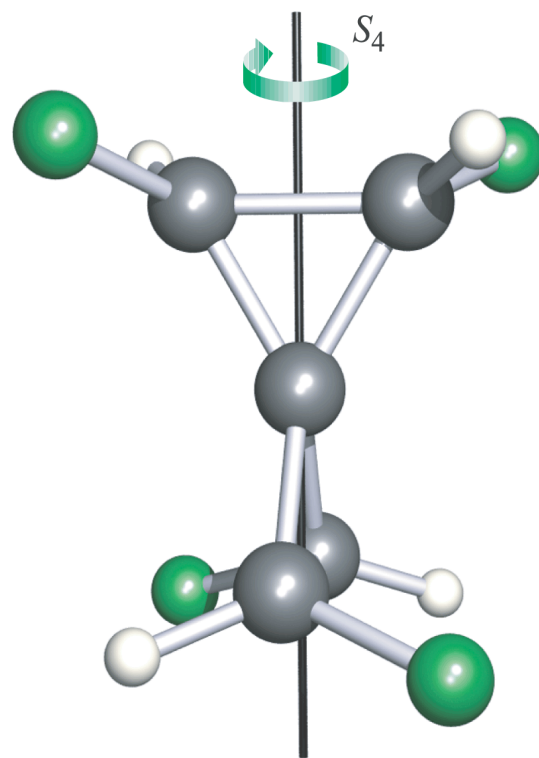
Δ -enantiomer

Λ -enantiomer

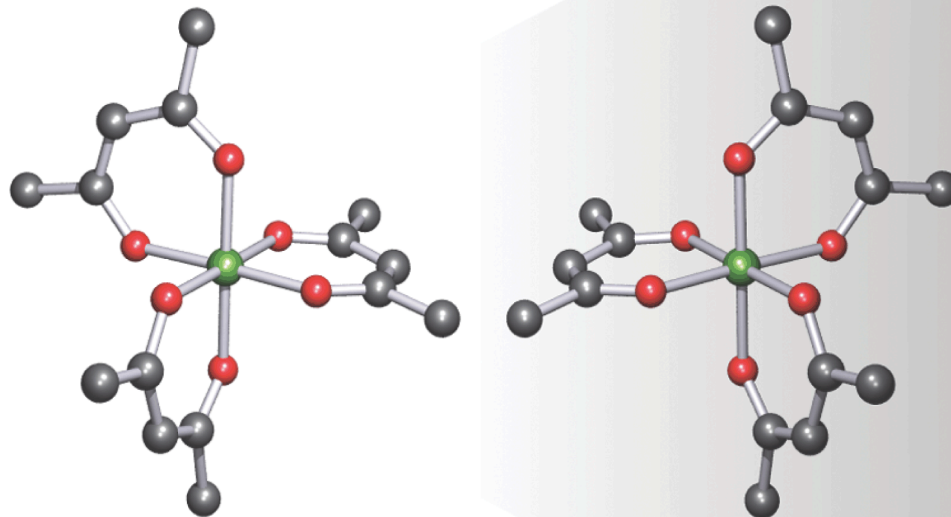
ogni molecola che non abbia S_n è chirale



Se_∞



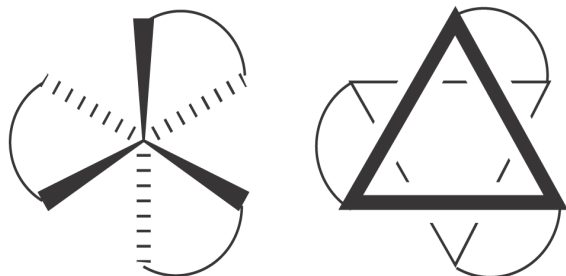
Tetrafluoro-spiropentano, S_4 , achirale



Δ -enantiomer

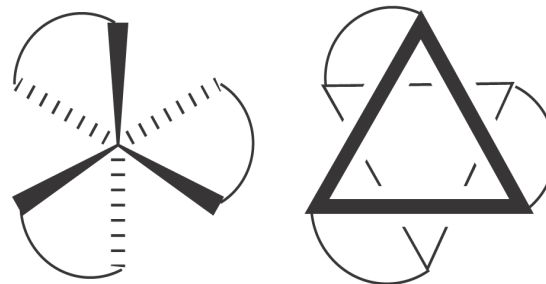
Λ -enantiomer

elica destrorsa

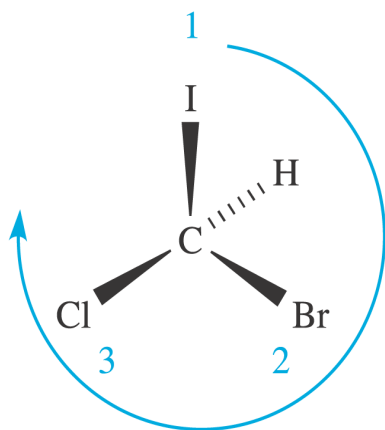


Δ

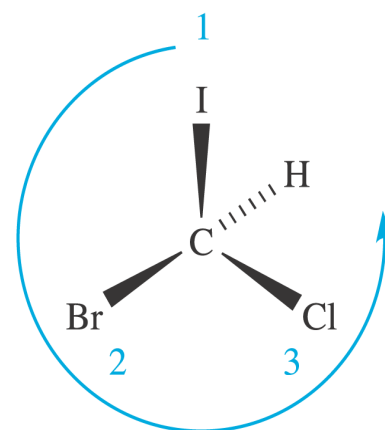
elica sinistrorsa



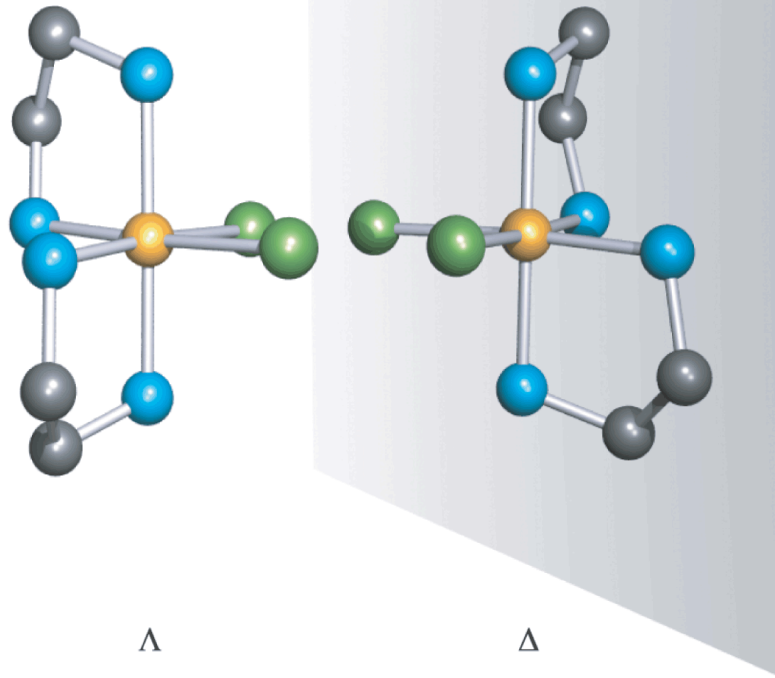
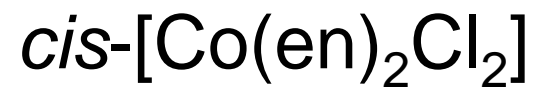
Λ

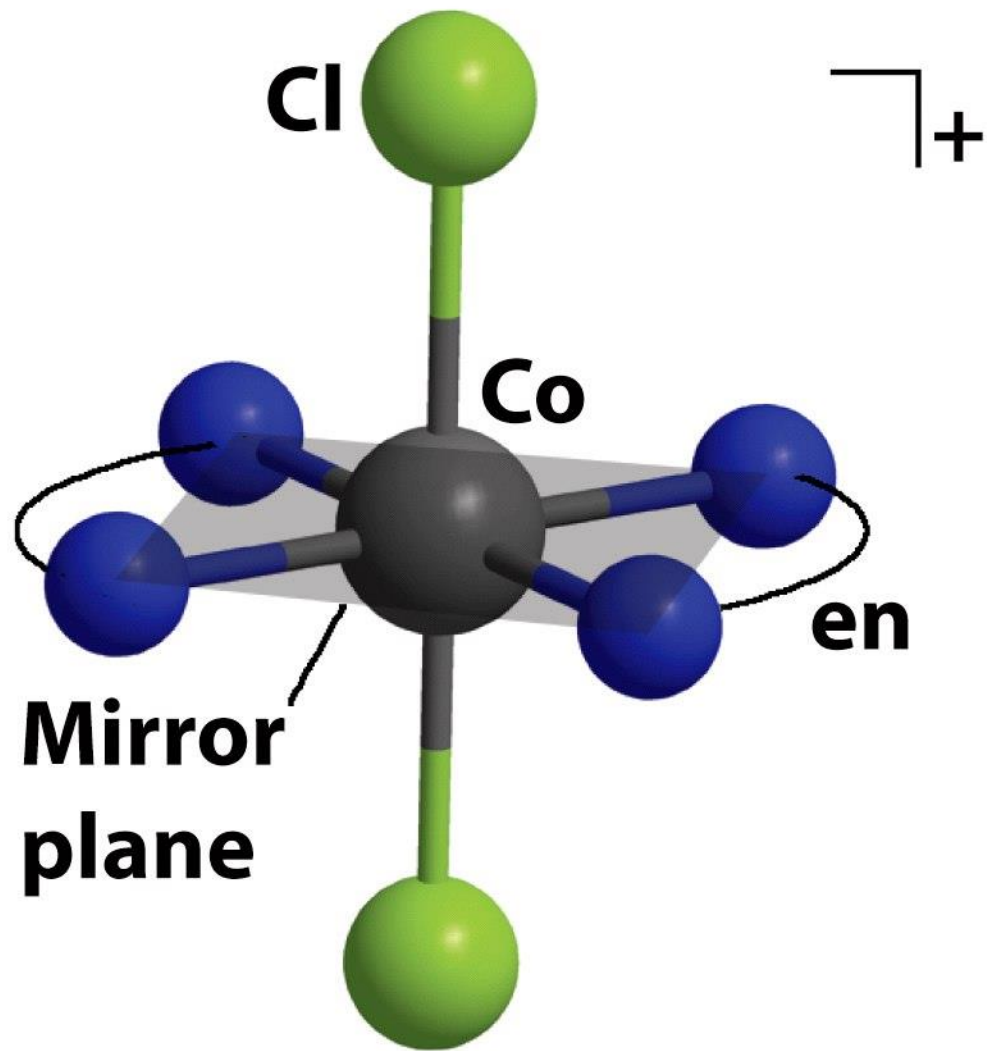


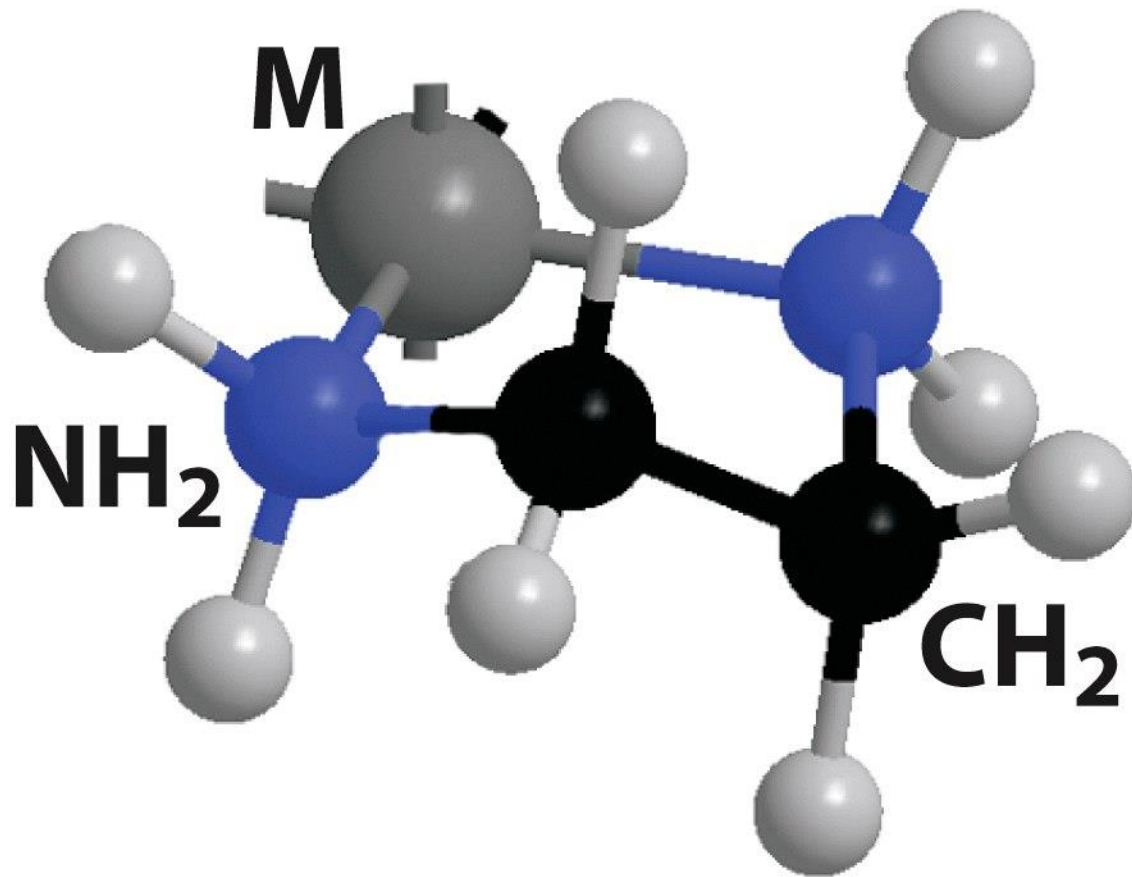
R



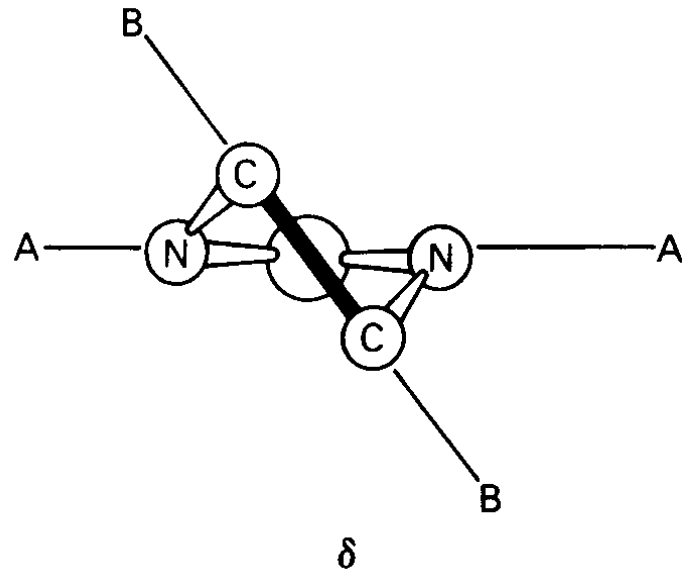
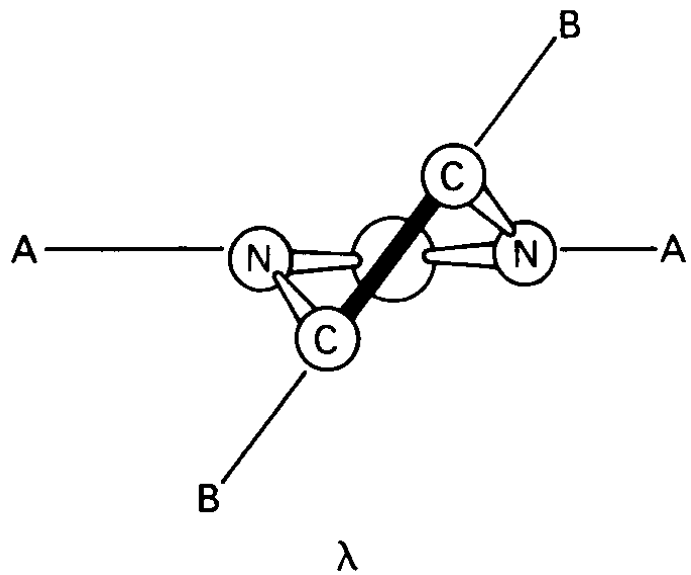
S

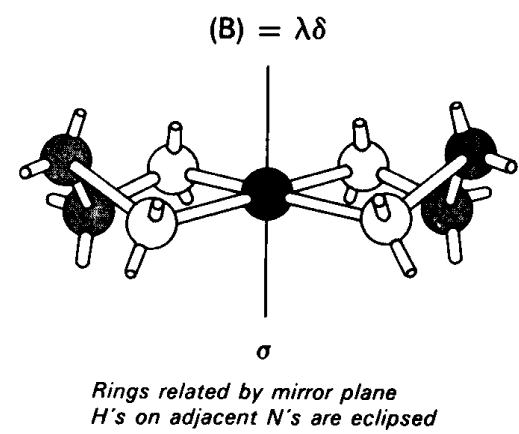
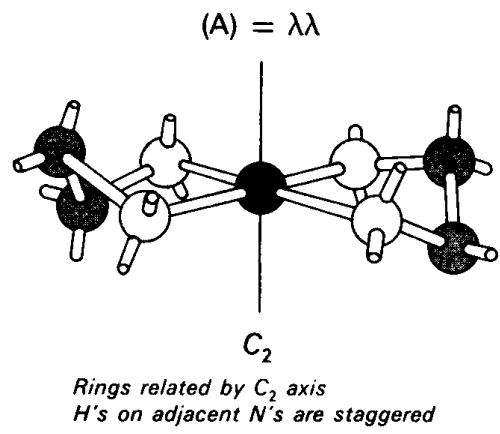
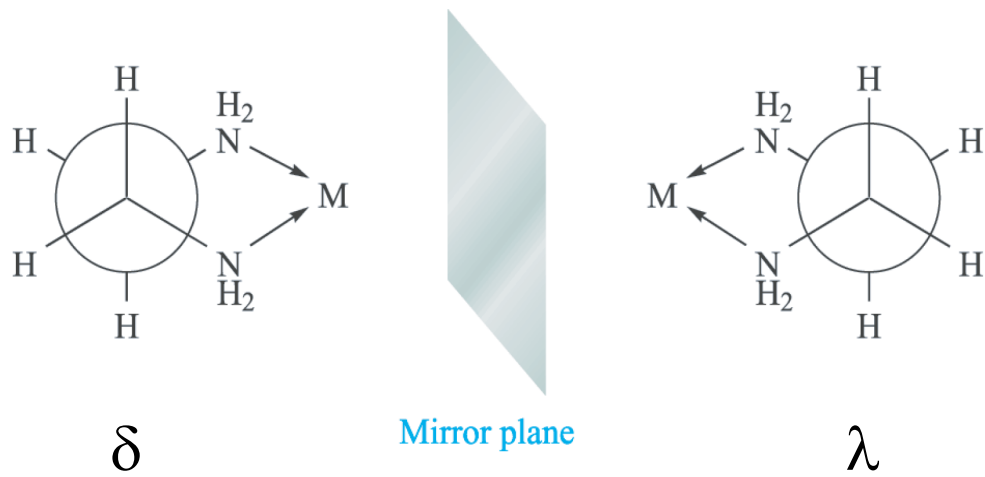


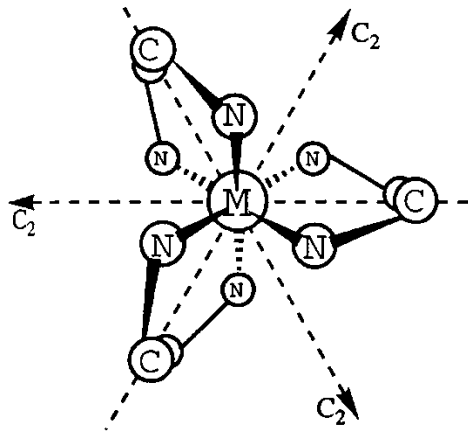




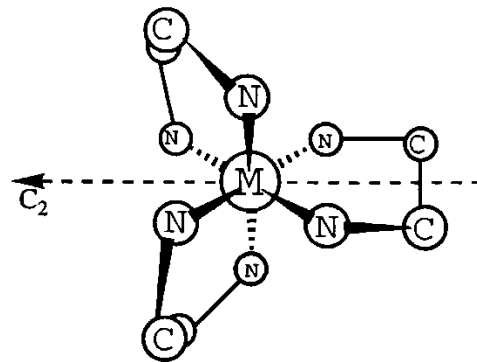
**Ethylenediamine (en)
ligand attached to M**



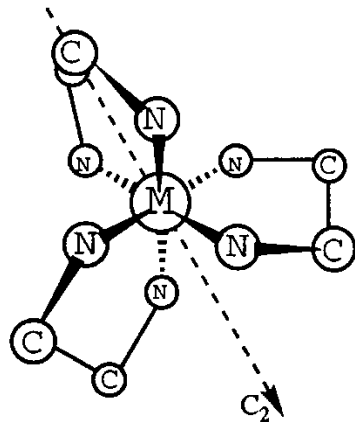




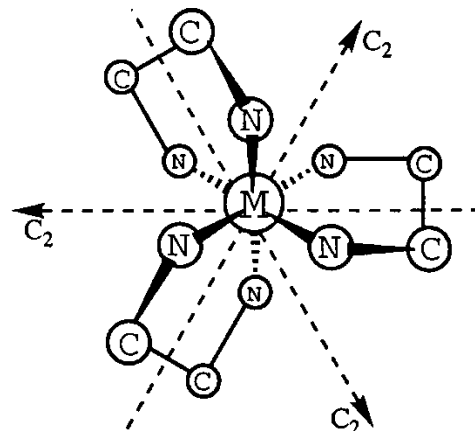
(a) $\Lambda(\delta, \delta, \delta)$
 D_3



(b) $\Lambda(\delta, \delta, \lambda)$
 C_2



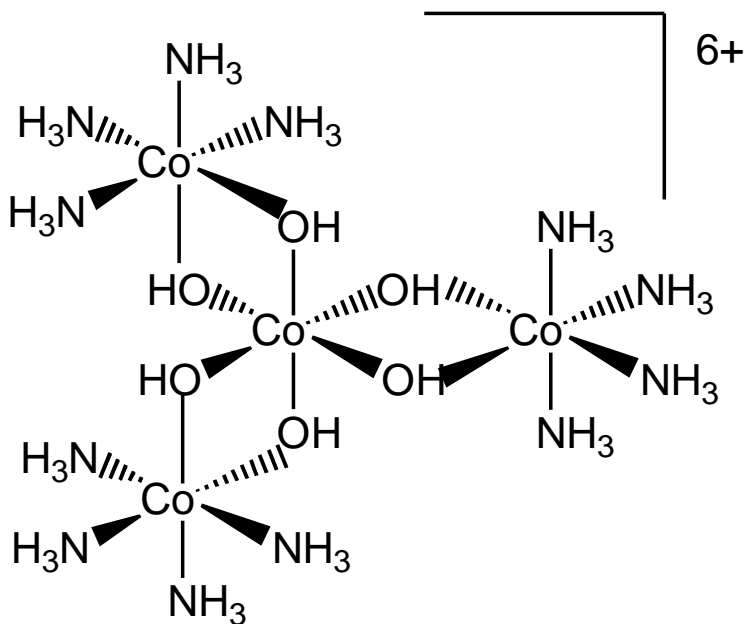
(c) $\Lambda(\delta, \lambda, \lambda)$
 C_2



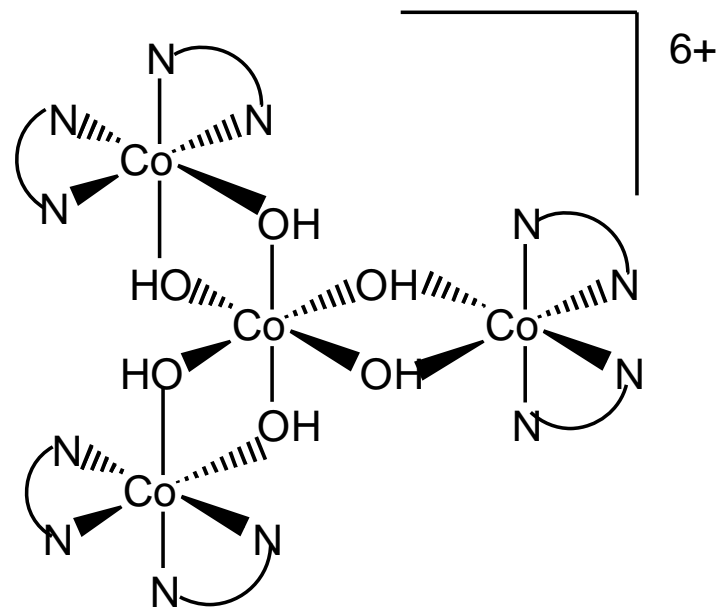
(d) $\Lambda(\lambda, \lambda, \lambda)$
 D_3

208 ($\lambda e \delta$)

2912 ($R e S$)



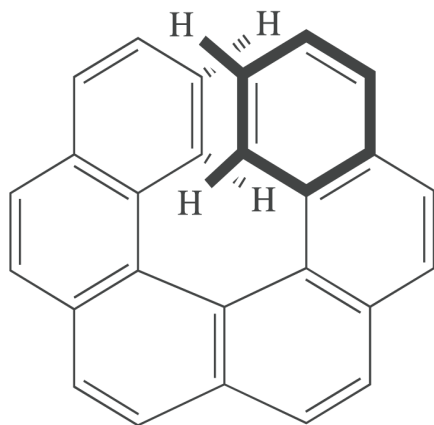
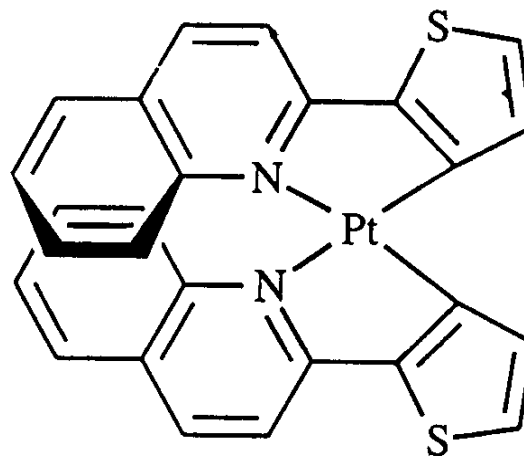
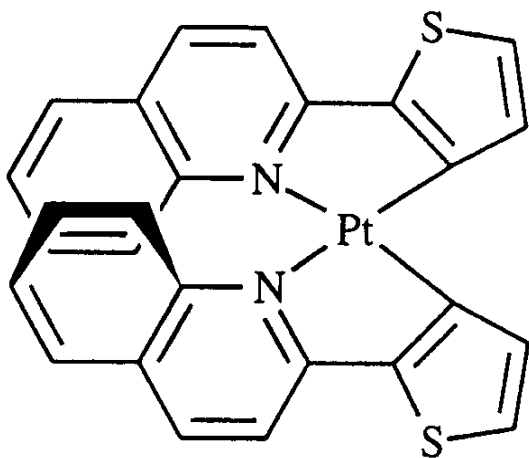
$\Lambda e \Delta$



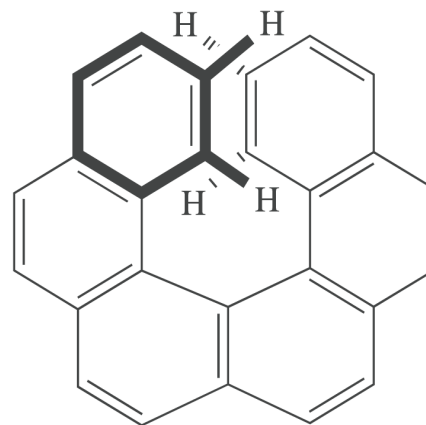
$\Delta(\Delta)_3$	$\Lambda(\Lambda)_3$
$\Delta\{(\Delta)_2\Lambda\}$	$\Lambda\{(\Lambda)_2\Delta\}$
$\Delta\{\Delta(\Lambda)_2\}$	$\Lambda\{\Lambda(\Delta)_2\}$
$\Delta(\Lambda)_3$	$\Lambda(\Delta)_3$

$\Delta(S)_6, \Delta(S)_5(R), \Delta(S)_4(R)_2, \Delta(S)_3(R)_3, \dots$

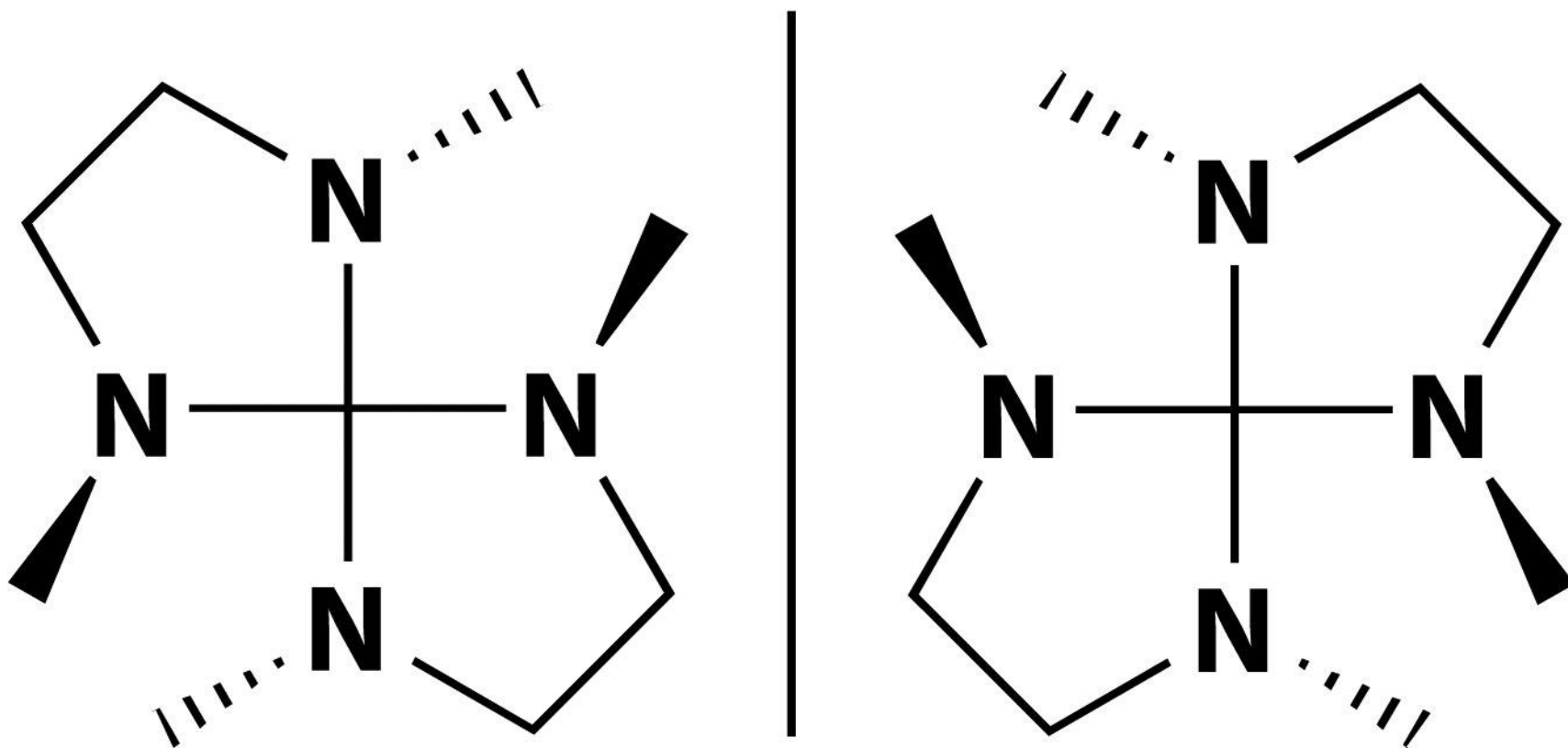
Chiralità nei complessi planari quadrati



(P)-hexahelicene

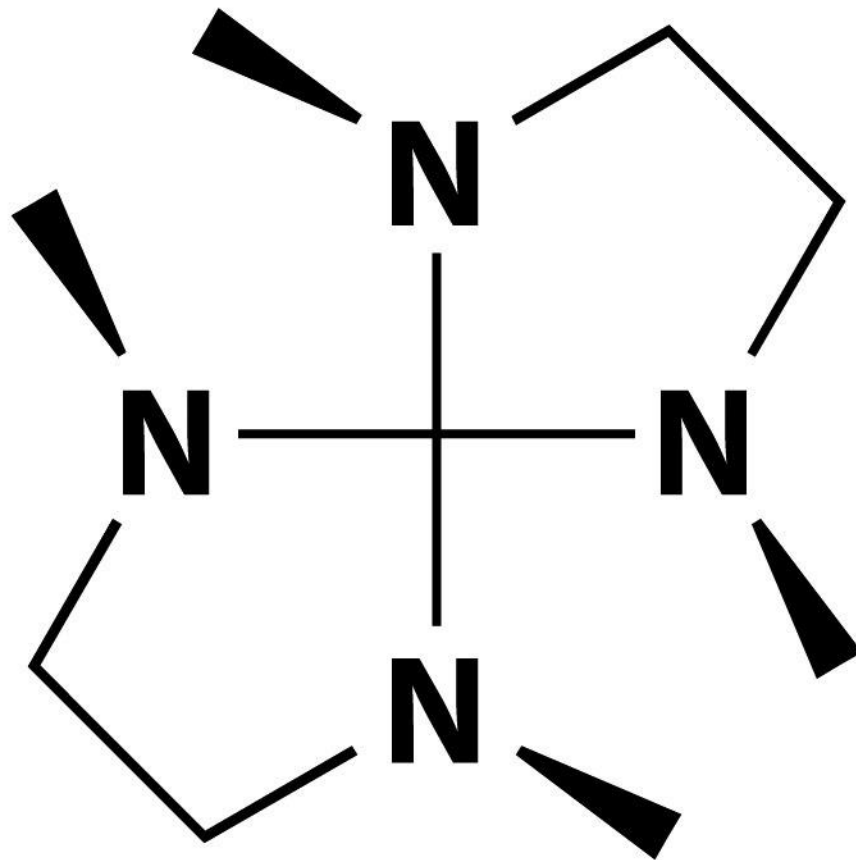


(M)-hexahelicene



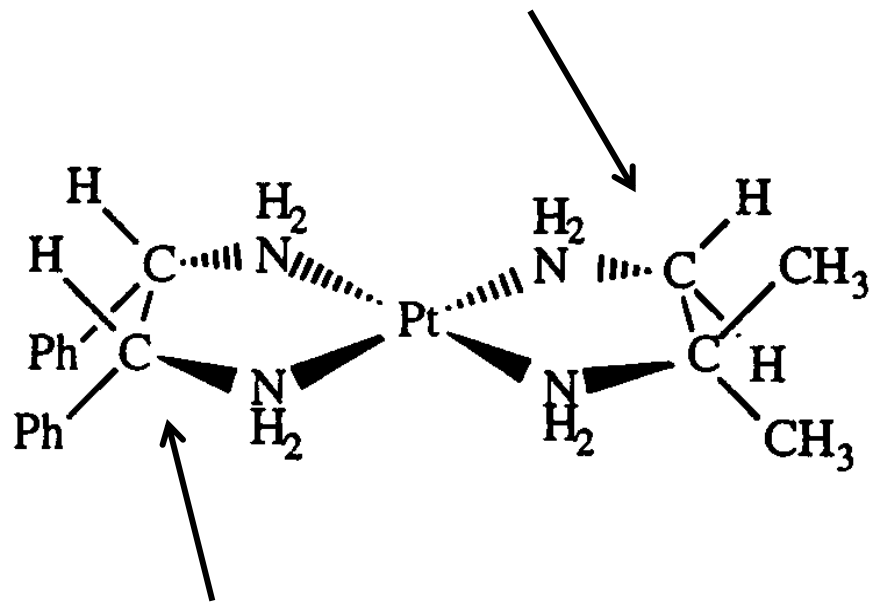
racemo

N diventa chirale in seguito alla coordinazione



meso

isobutylene-diammina



meso-stilbenediammina

