Teoria Hibridizării Orbitalilor Atomici

Hibridizare sp

Hibridizare sp^2

Hibridizare sp^3

Hibridizare d^3s

Hibridizare sp^3d

Hibridizare sp^3d^2

Hibridizare sp^3d^3

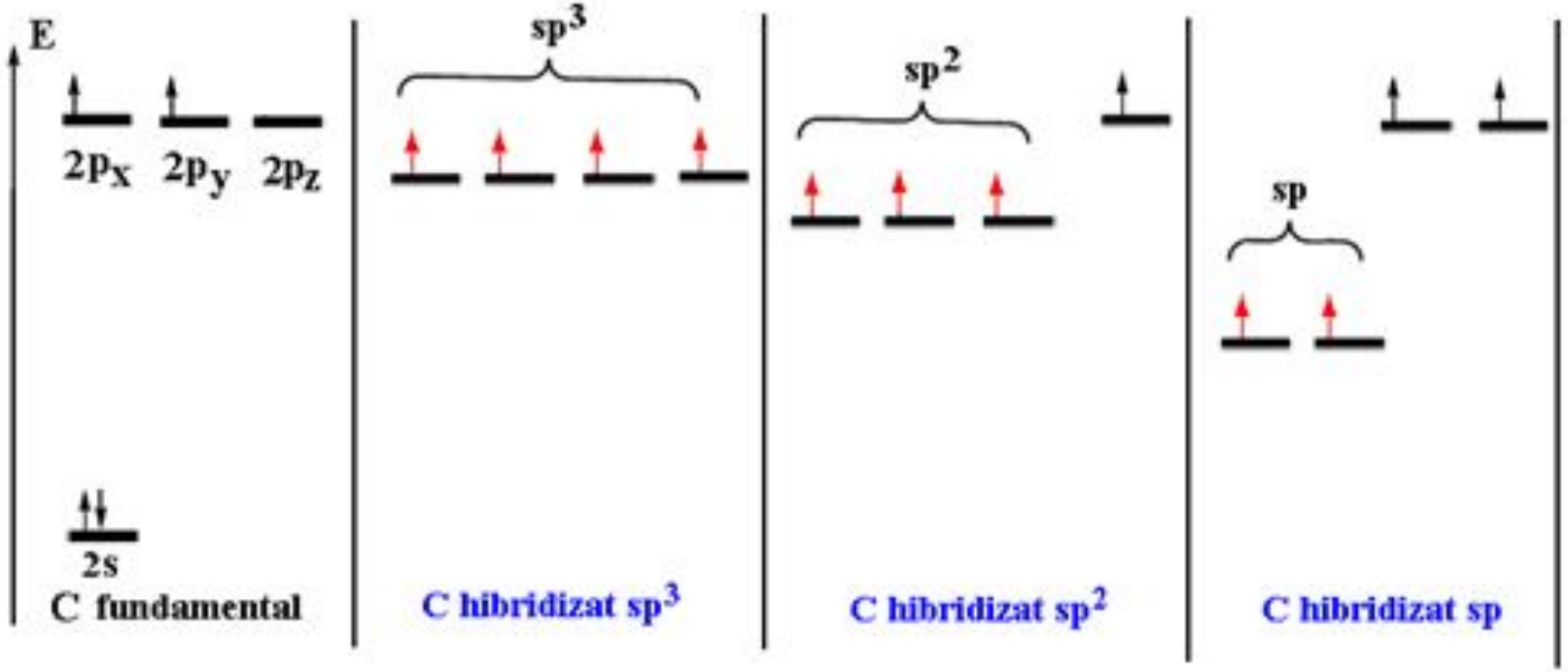
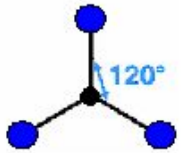
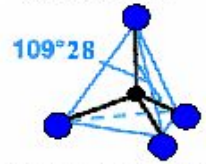
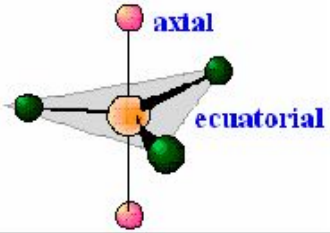
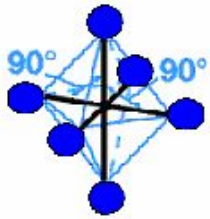
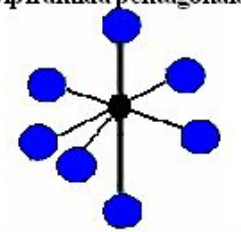


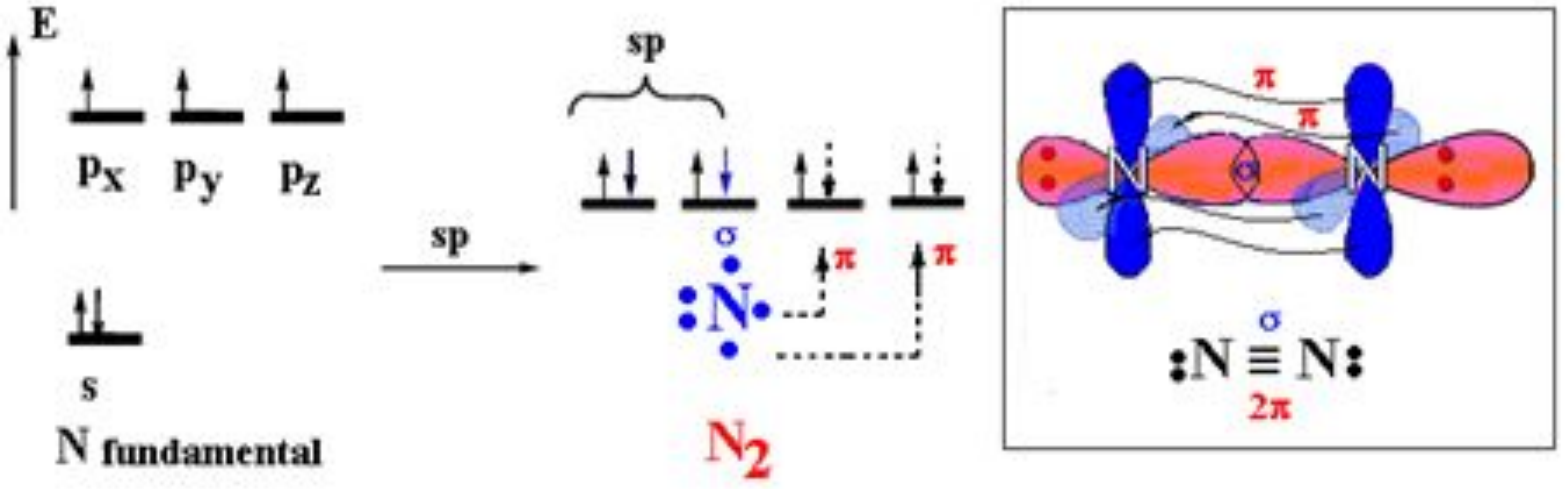
Fig. 3.16. Hibridizarea atomului de carbon.

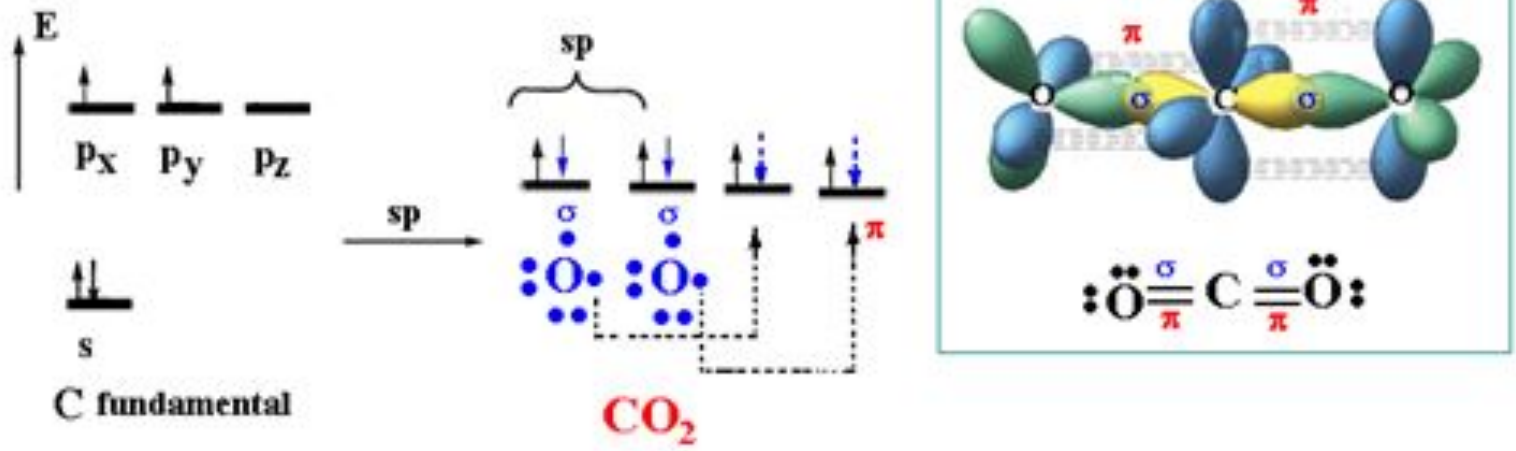
Număr de coordinare	Hibridizare	Geometrie
2	sp	Liniară
3	sp^2	Trigonală
4	sp^3	Tetraedrică
4	dsp^2	Plan-pătratică
5	dsp^3, d^3sp	Bipiramidal-trigonală
5	d^2sp^2, d^4s	Piramidă pătratică
6	d^2sp^3, sp^3d^2	Octaedrică
7	d^3sp^3, sp^3d^3	Bipiramidal-pentagonală

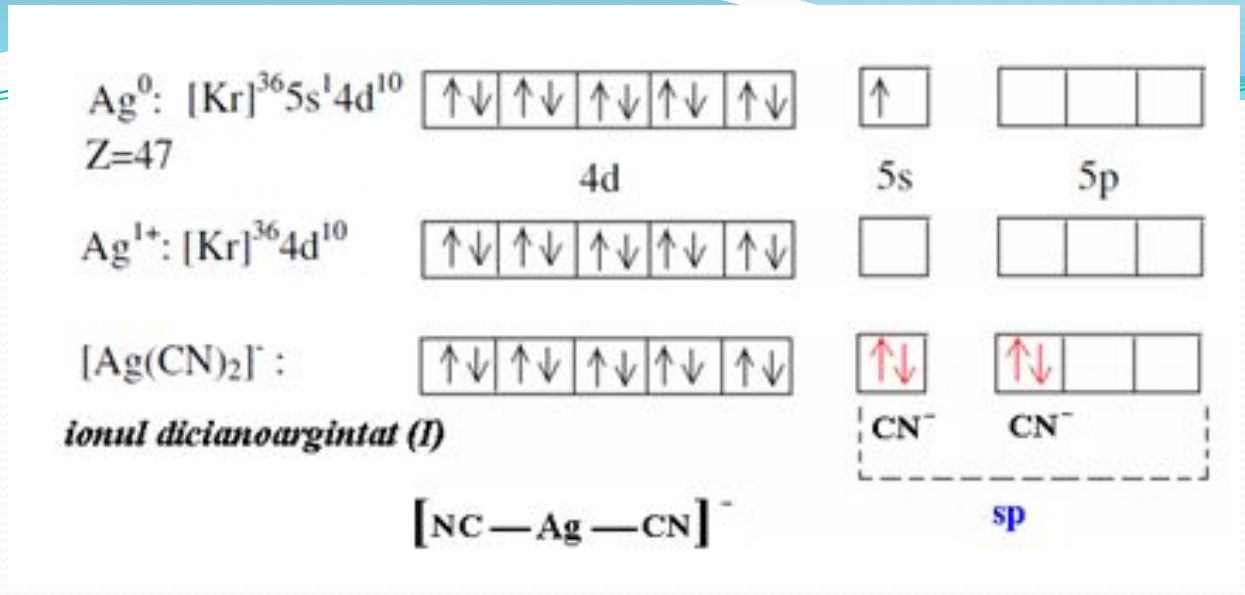
Tabel 3.2. Principalele tipuri de hibridizare şi geometriile corespunzătoare.

Hibridizare	Geometrie	Exemple
sp	Liniara (unghiulara)  	$BeCl_2$ CO_2 C_2H_2 HCN, O_2
sp^2	Triunghiulara  	BF_3, $AlBr_3$ BCl_3 NO_3^- CO_3^{-2} SO_2 C_2H_4 O_3
sp^3	Tetraedrica  	CH_4, CCl_4, NH_4^+ PO_4^{-3}, SO_4^{-2}, ClO_4^{-1} NH_3, H_3O^+, PCl_3 H_2O, F_2O C_2H_6
sp^3d	Bipiramida triunghiulara  	PCl_5 PF_5 $Fe(CO)_5$ SCl_4 SF_4 ICl_3 XeF_2 ClF_3
sp^3d^2	Octaedrica  	SF_6 XeF_4 ICl_4^- $XeOF_4$ $[AlF_6]^{-1}$ $[PF_6]^{-1}$ ClF_5
sp^3d^3	Bipiramida pentagonala 	IF_7 XeF_6

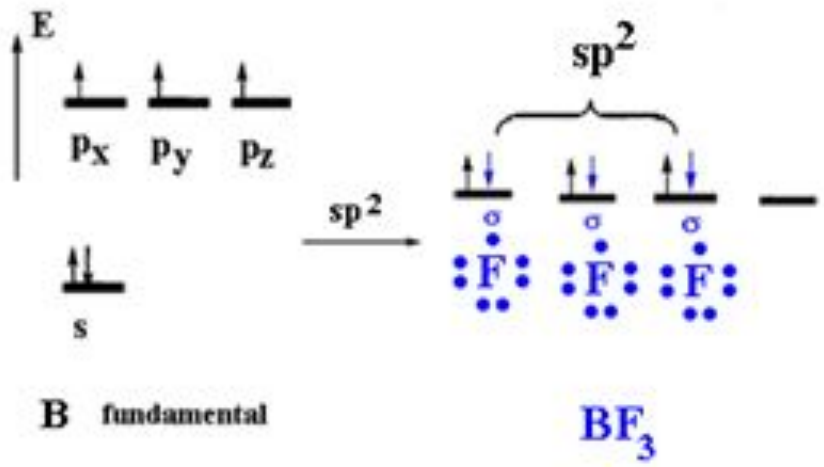
Hibridizare sp

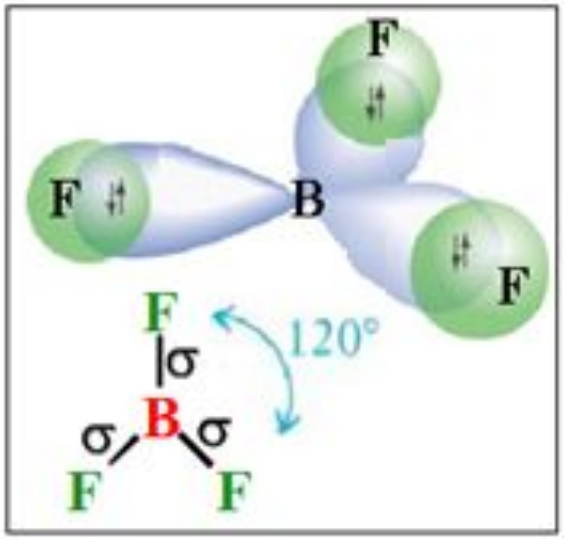




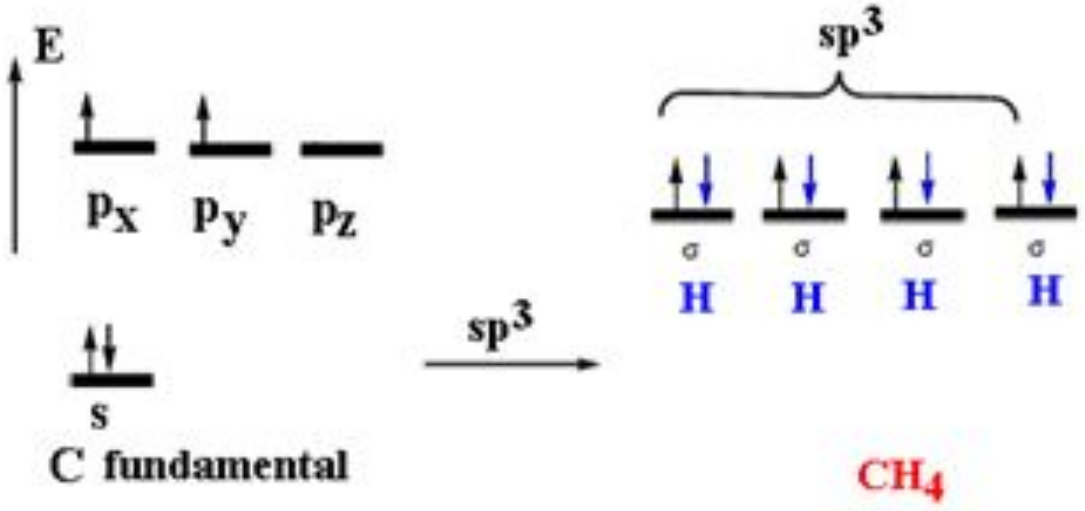


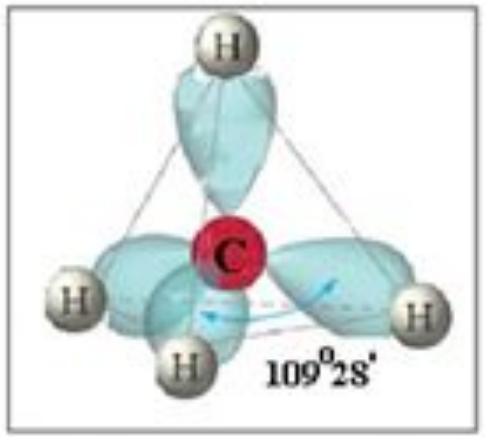
2. Hibridizare sp^2

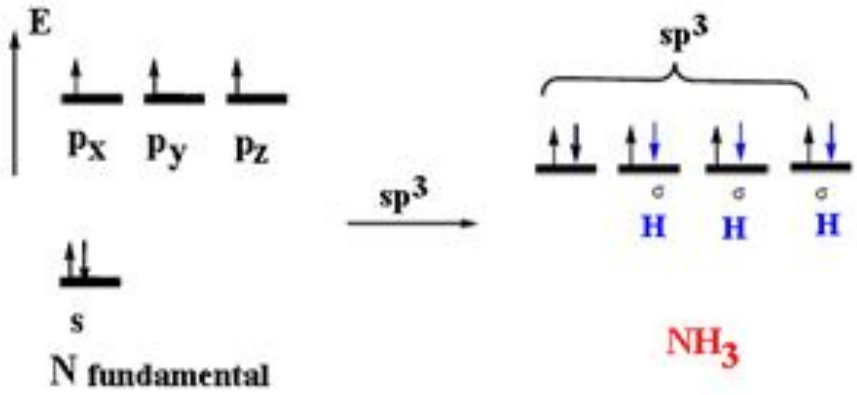


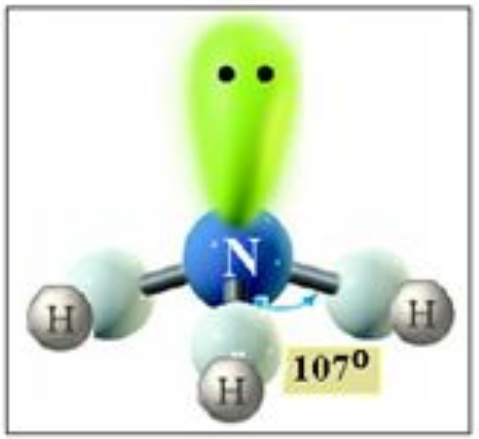


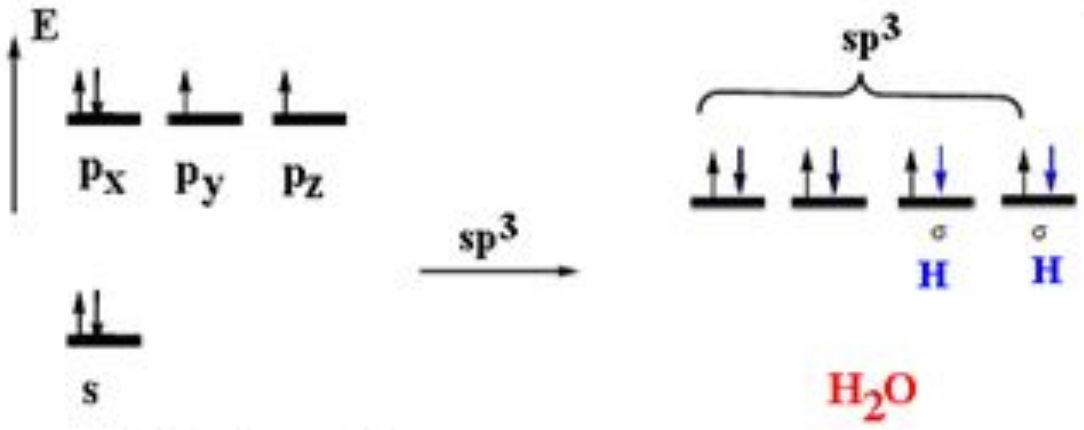
3. Hibridizare sp^3







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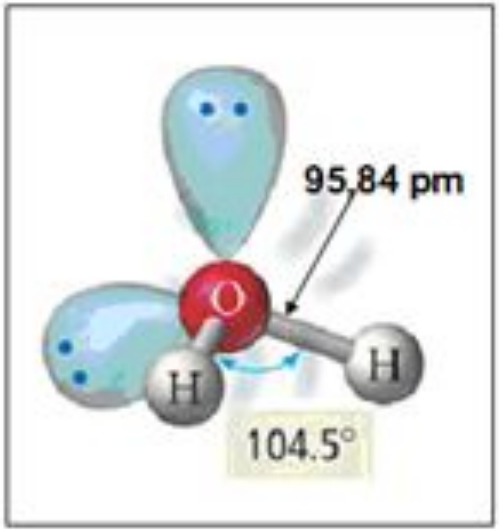
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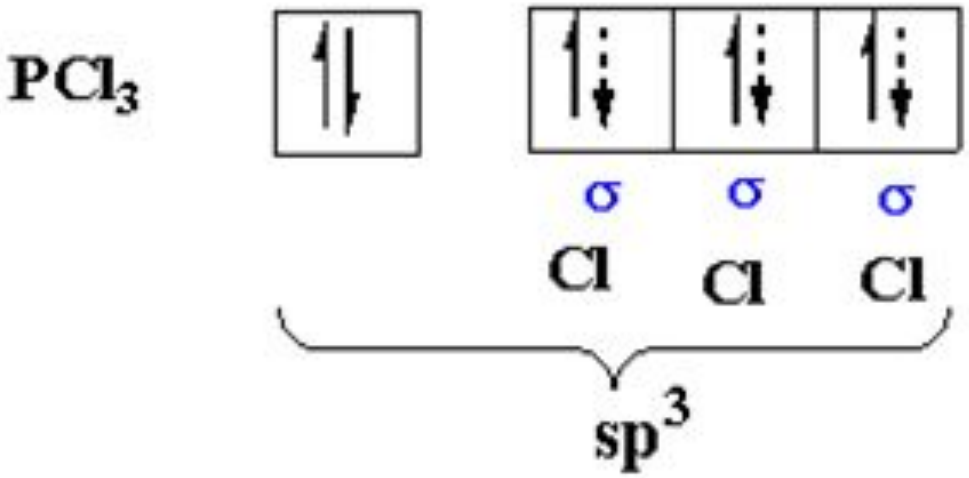
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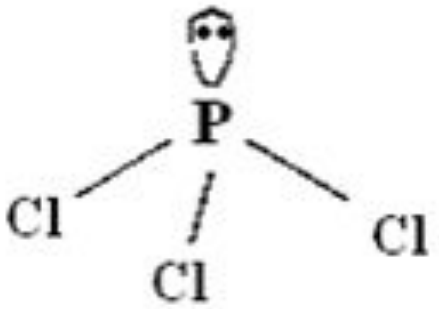
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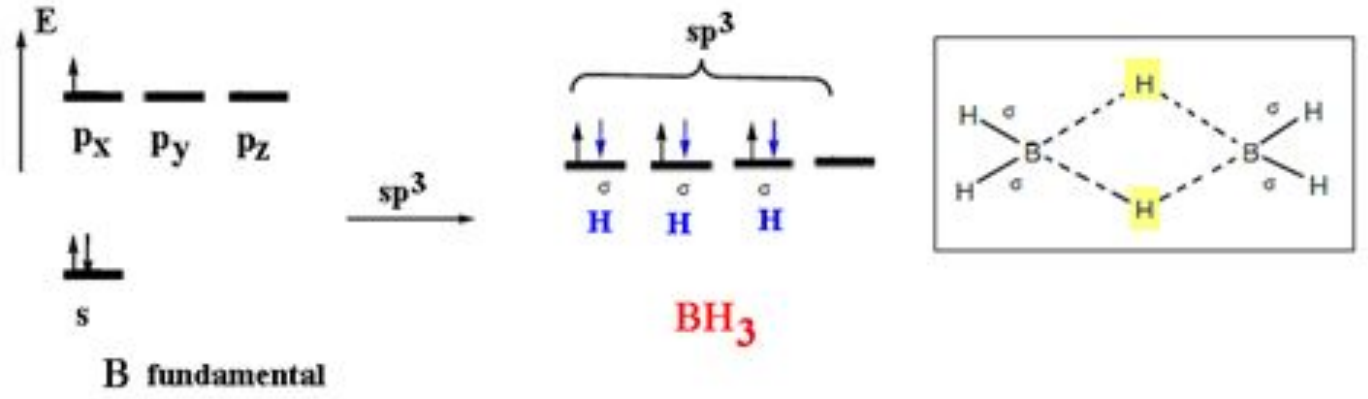
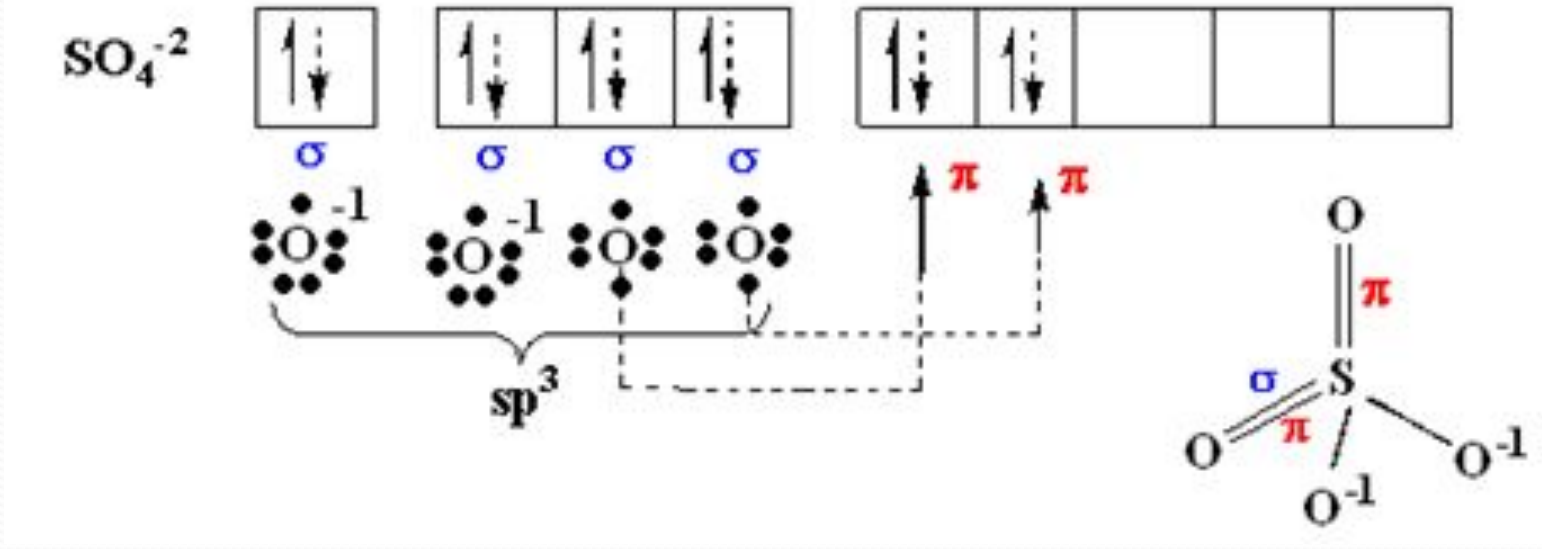
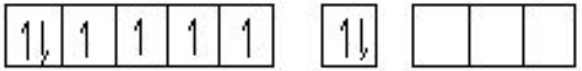


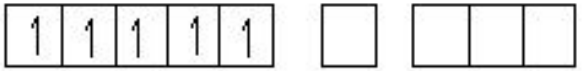


Aplicație: Determinați geometria și hibridizarea în: ClO_4^{-1}, PO_4^{-3}.

Fe: [Ar] $3d^6\ 4s^2$



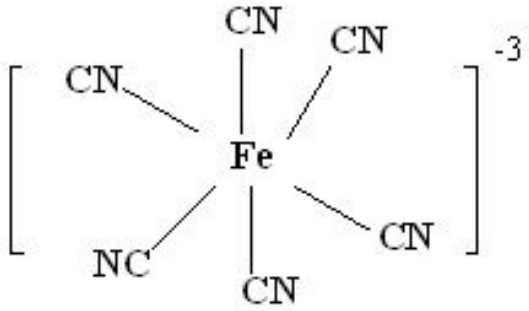
Fe^{+3}: [Ar] $3d^5\ 4s^0$



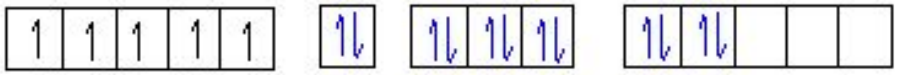
$Fe[(CN)_6]^{-3}$:

CN^- CN^- CN^- CN^- CN^- CN^-

d^2sp^3

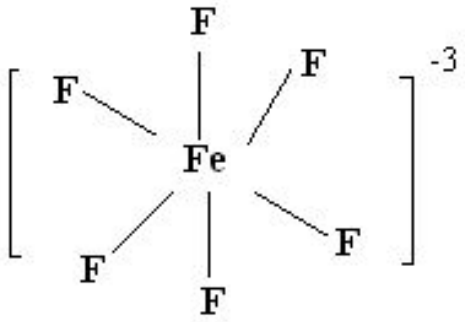


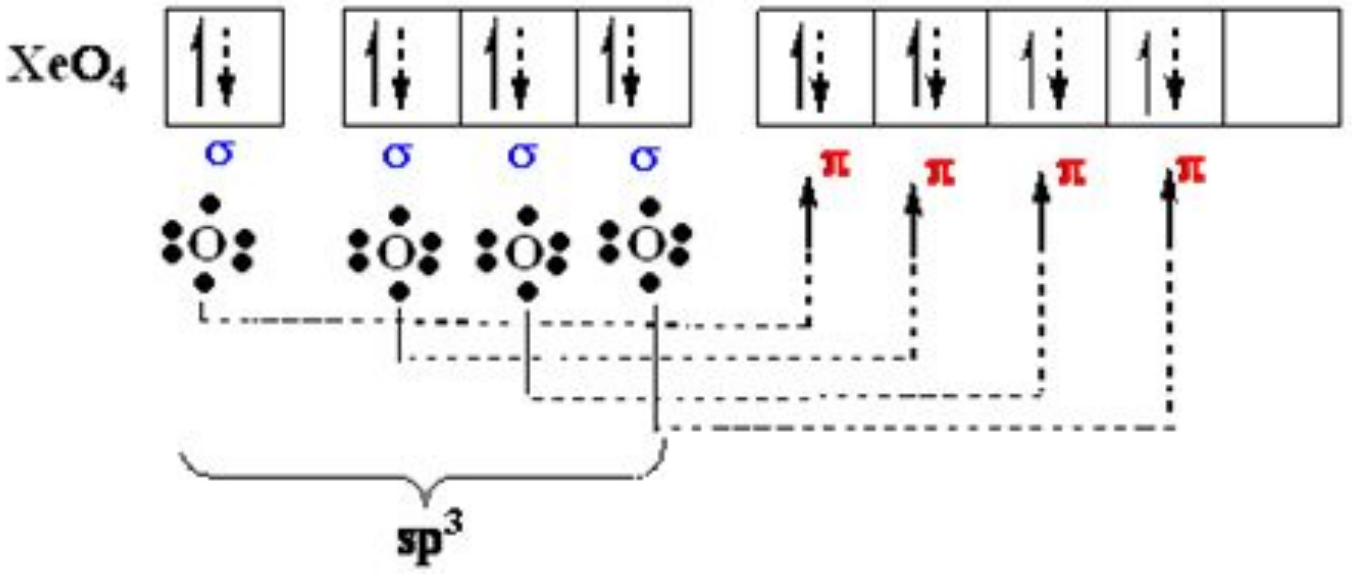
$[FeF_6]^{-3}$:



F^- F^- F^- F^- F^- F^-

sp^3d^2

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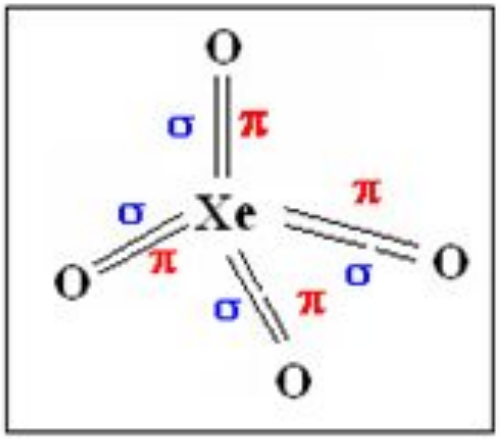
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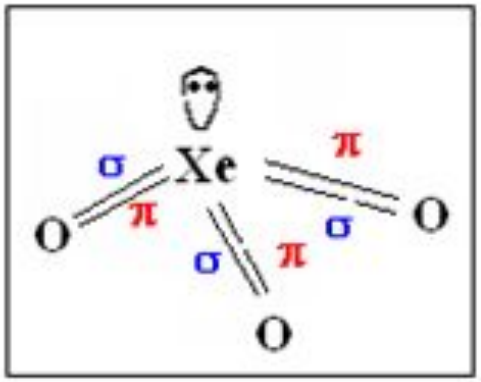
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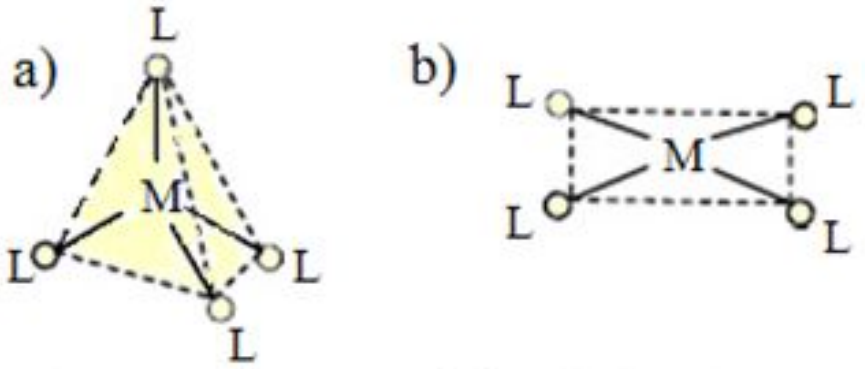


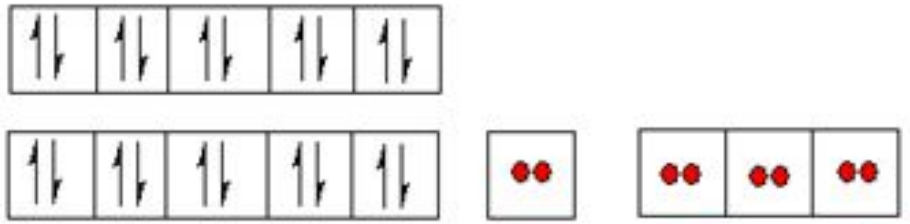
Geometrii caracteristice N.C.=4
a) tetraedru; b) geometrie plan-pătrată

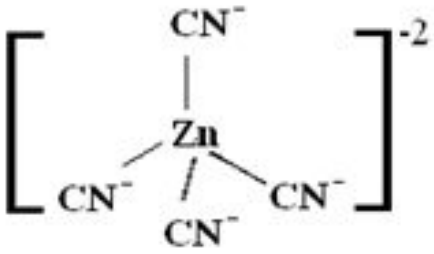
|

Zn: [18] $3d^{10}$ $4s^2$

Zn^{+2}: [18] $3d^{10}$

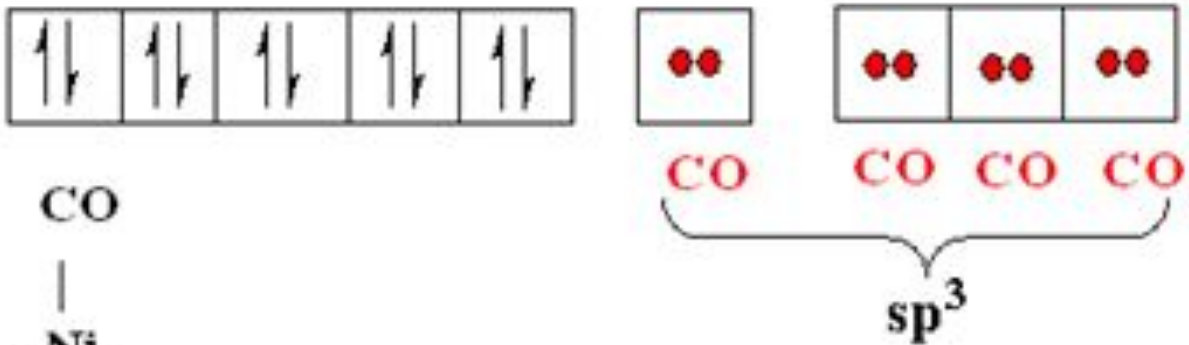
$[Zn(CN)_4]^{-2}$:

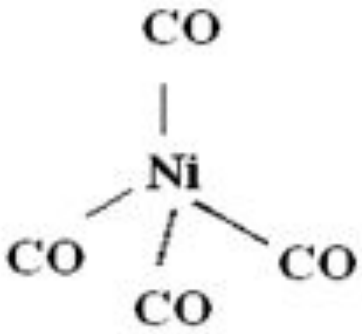




Ni: [18] $3d^8\ 4s^2$

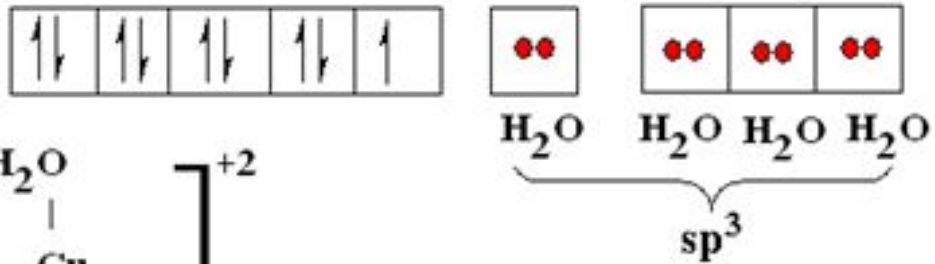
$Ni(CO)_4$:

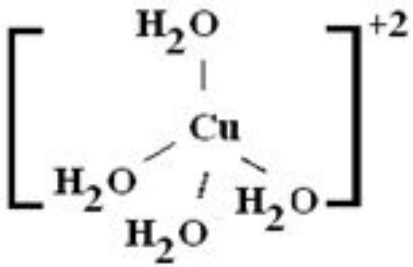




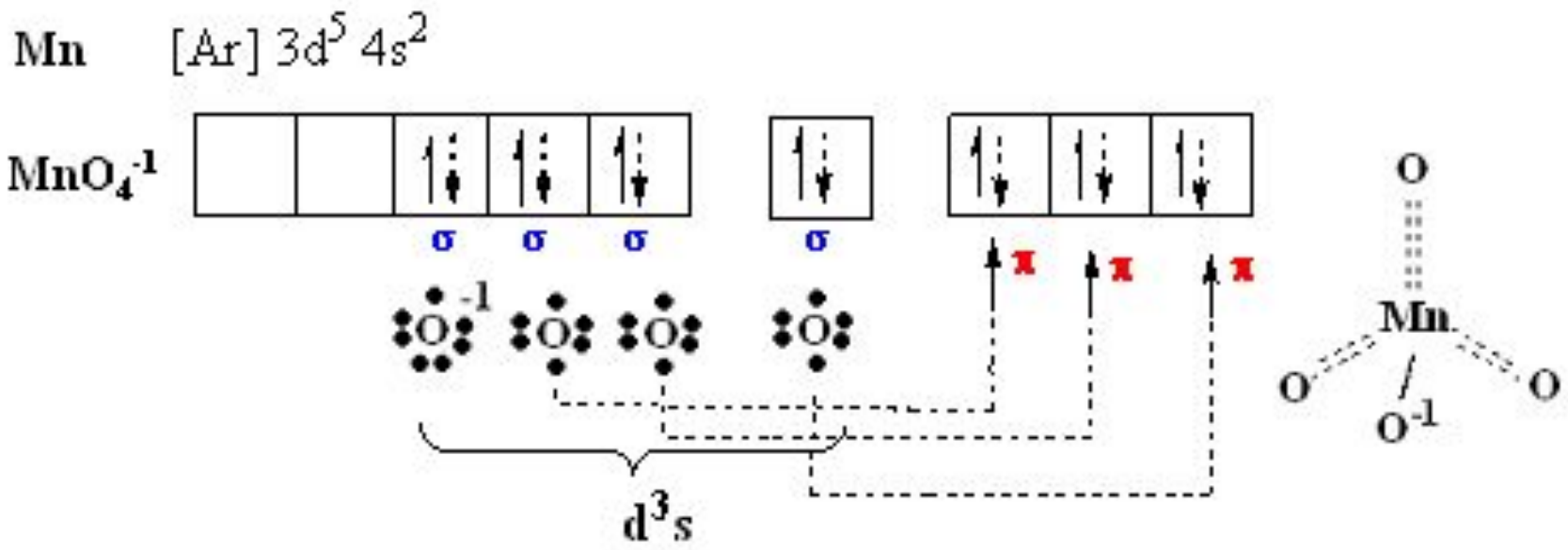
Cu : [18] $3d^{10}\ 4s^1$

$[Cu(H_2O)_4]^{+2}$



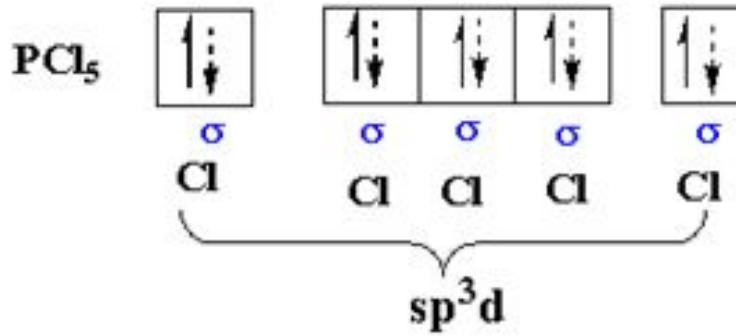


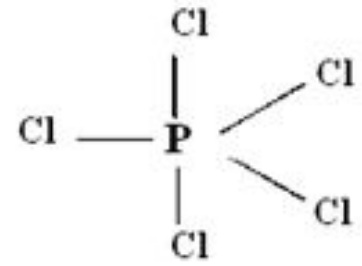
Hibridizare d^3s

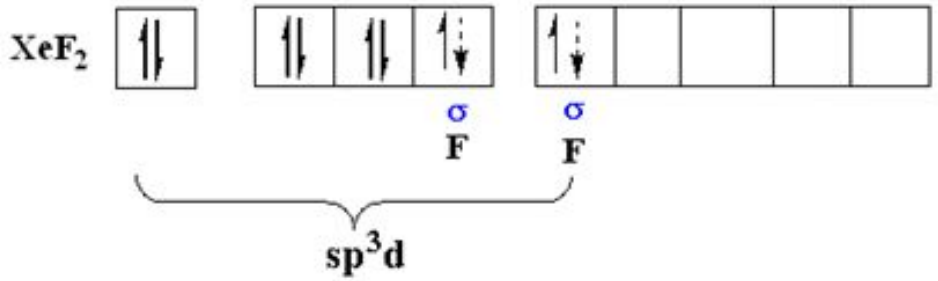


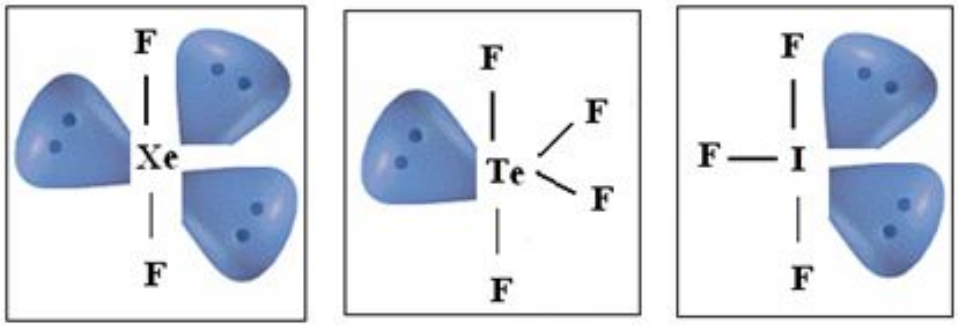
Aplicație: Determinați geometria și hibridizarea în: CrO_4^{-2}, VO_4^{-3}.

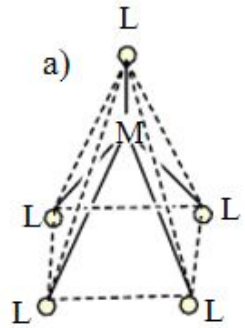
Hibridizare sp^3d

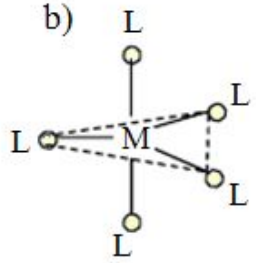








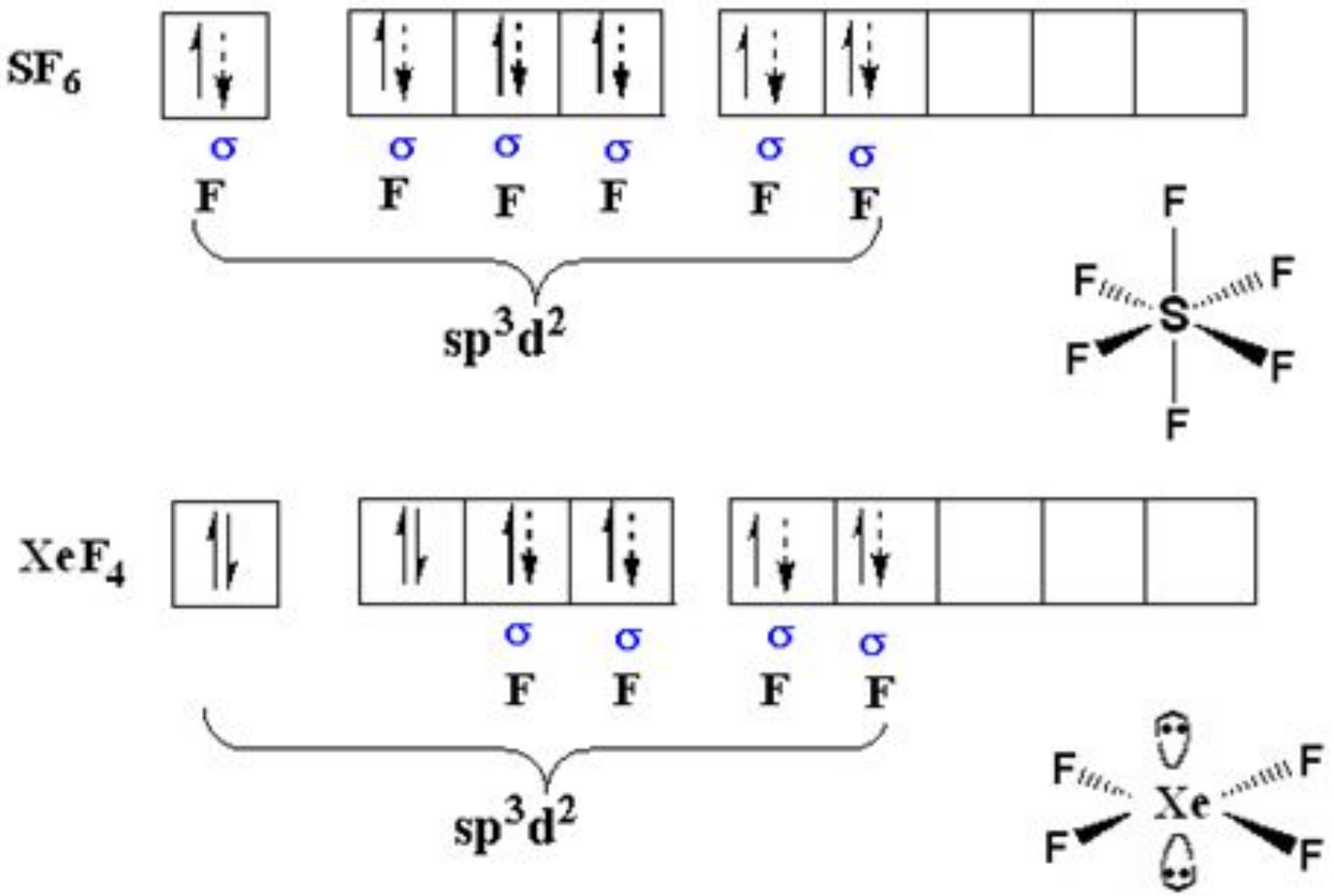




Geometrii caracteristice N.C.=5
a) piramidală tetragonală; b) bipiramidă trigonală

Aplicație: Determinați geometria și hibridizarea în: XeF_2, TeF_4, IF_3.

Hibridizare sp^3d^2 și d^2sp^3



Fe: [Ar] $3d^6\ 4s^2$ 

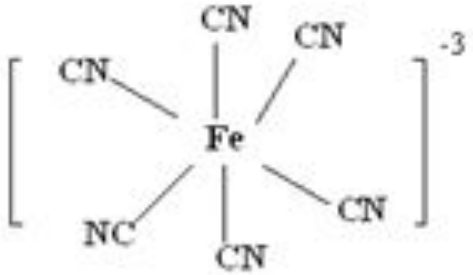
Fe^{+3}: [Ar] $3d^5\ 4s^0$ 

$[Fe(CN)_6]^{-3}$: 

CN^- CN^- CN^- CN^- CN^- CN^-

d^2sp^3

- complex de sferă interioară
- proprietăți diamagnetice

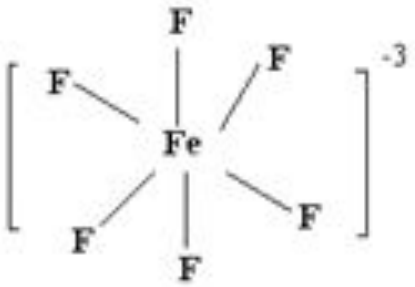


$[FeF_6]^{-3}$: 

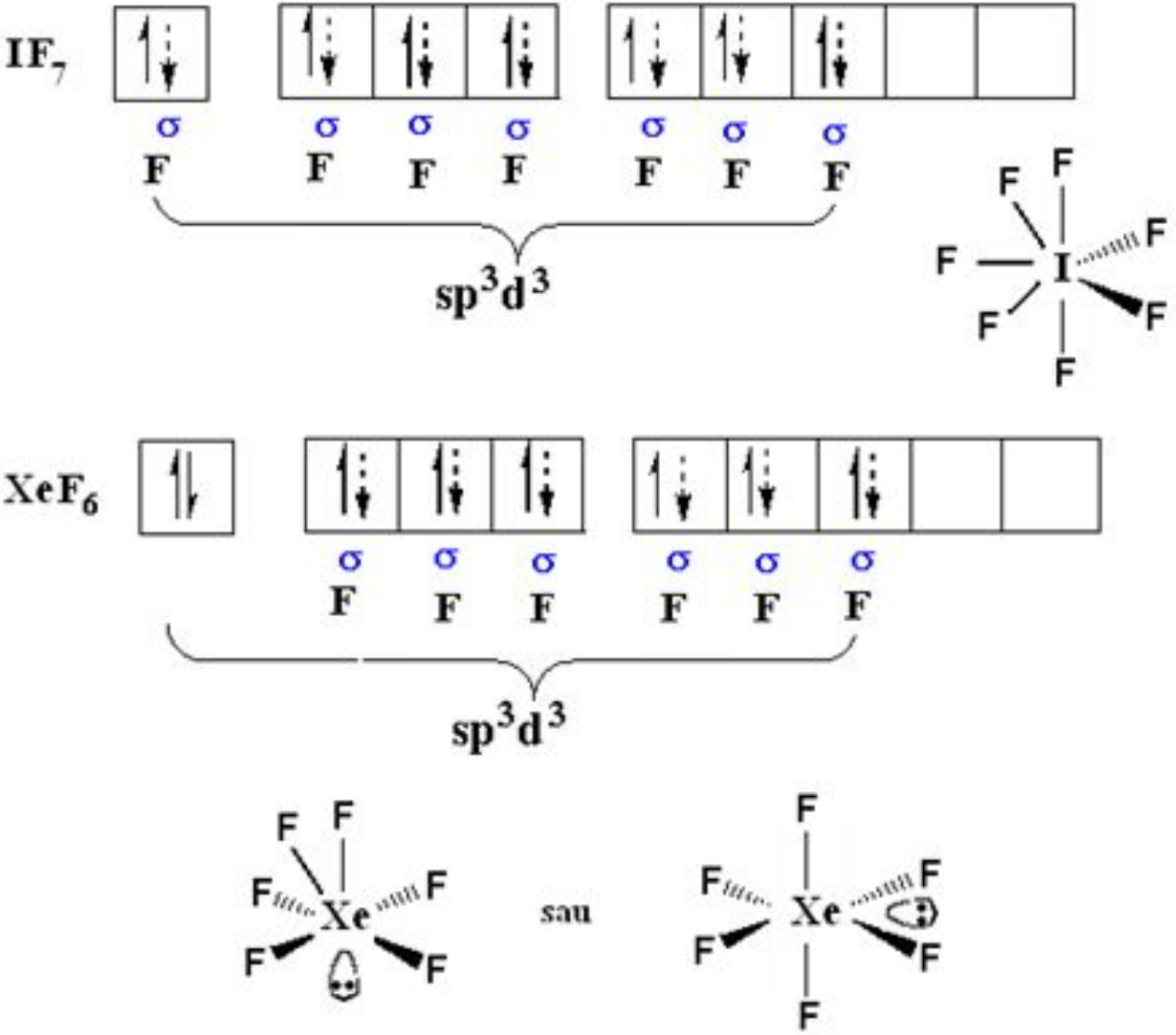
F^- F^- F^- F^- F^- F^-

sp^3d^2

- complex de sferă exterioară
- proprietăți paramagnetice



Hibridizare sp^3d^3



Aplicații:

1. Determinați hibridizarea și geometria în următorii compușii:
PO_4^{-3}, SO_4^{-2}, ClO_4^{-1}, MnO_4^{-1}, CrO_4^{-2}, VO_4^{-3}, PCl_3, PCl_5, SF_6, TeF_4, IF_3, XeF_4, XeF_6, $XeOF_4$, XeO_3, PCl_6^{-1}, PCl_4^{+}, AlF_6, ICl_4^{-1}.

2. Modelați formarea legăturilor ionice din următorii compuși:
MgO, Mg_2N_3, KOH, Al_2S_3, $CsCl$, $CaCl_2$.

3. Modelați formarea legăturilor covalente în următoarele molecule:
H_2, F_2, He_2, Ar_2, I_2.

4. Determinați hibridizarea și geometria în următorii compuși:

a) PO_4^{-3}, SO_4^{-2}, ClO_4^{-1}, MnO_4^{-1}, CrO_4^{-2}, VO_4^{-3}, PCl_3, PCl_5, SF_6, XeF_2, XeF_4, XeF_6, $XeOF_4$, XeO_3, IF_7, PCl_6^{-1}, PCl_4^{+}, AlF_6, ICl_4^{-1}.

b) $[Ag(CN)_2]^{-1}$; $[HgI_3]^{-1}$; $[Al(OH)_4]^{-1}$; $[Fe(CN)_6]^{-4}$; $[Fe(CN)_6]^{-3}$; $[Ag(NH_3)_2]^{+}$; $[Cu(NH_3)_4]^{+2}$; $[Co(NH_3)_6]^{+3}$; $[CuF_6]^{-3}$; $[PtCl_4]^{-2}$