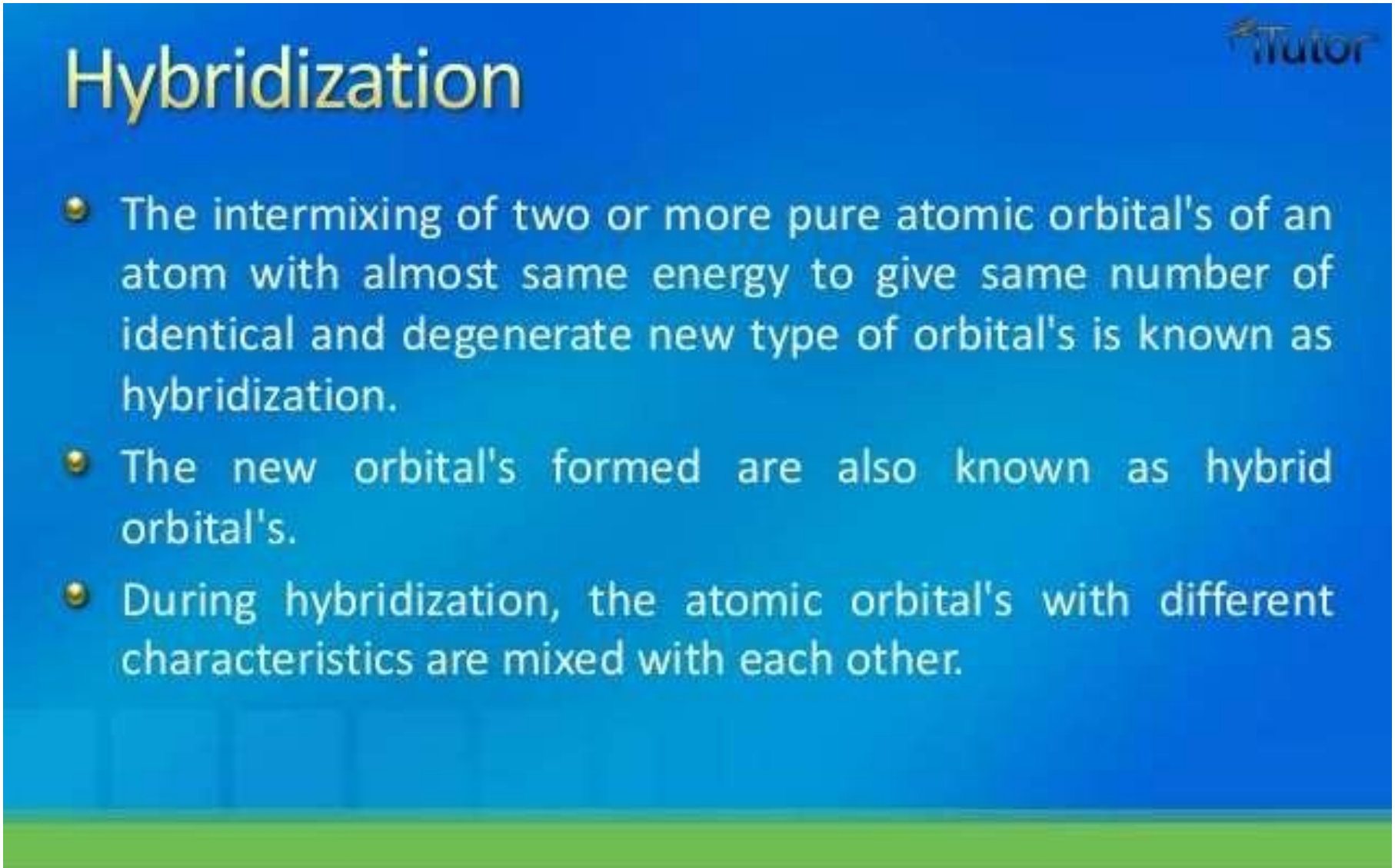
Dr. Pallavi Kadam

Hybridization



Hybridization

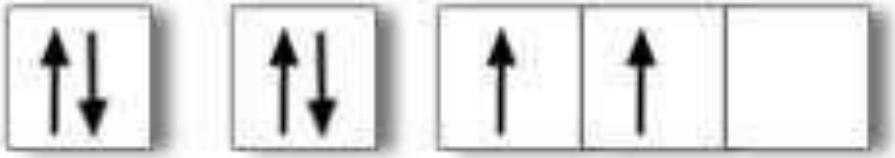
n	hybridization	electron-pair geometry
4	sp^3	tetrahedral
3	sp^2	planar trigonal
2	sp	linear

Hybridization

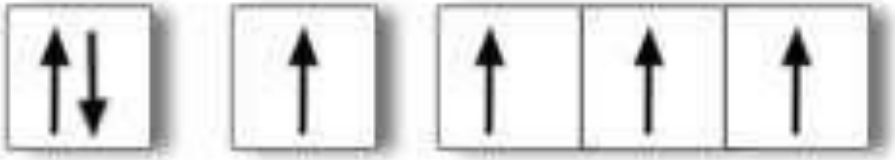
Types of Hybridization	Atomic Oribitals Involved	Sparial Orientation of Hybrid Orbitals
sp^3d	$s + p_x + p_y + p_z + d_z^2$ (outer shell)	Trigonal bipyramidal
dsp^3	$d_z^2 + s + p_x + p_y + p_z$ (inner shell)	Trigonal bipyramidal
sp^3d^2	$s + p_x + p_y + p_z + \underbrace{d_z^2 + d_{x^2-y^2}}$ (outer shell)	Octahedral
d^2sp^3	$\underbrace{d_z^2 + d_{x^2-y^2}} + s + p_x + p_y + p_z$ (inner shell)	Octahedral
dsp^2	$d_{x^2-y^2} + s + p_x + p_y$ (inner shell)	Square planar
sp^3d^3	$s + p_x + p_y + p_z + d_{xy} + d_{yz} + d_{xz}$	Pentagonal bipyramidal

Sp3 hybridization

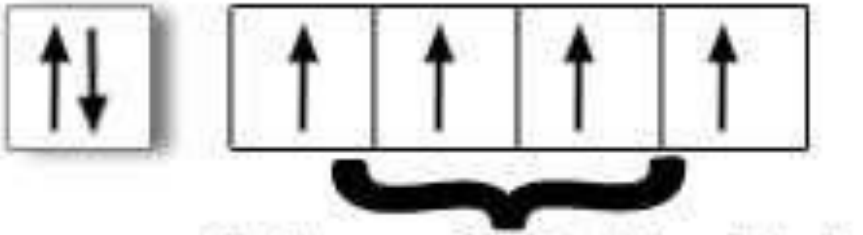
Carbon atom in ground state



Carbon atom in excited state

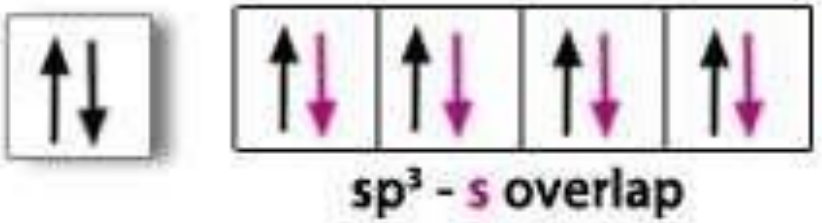


Carbon atom in hybridized state



METHANE MOLECULE

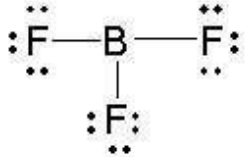
(CH_4)

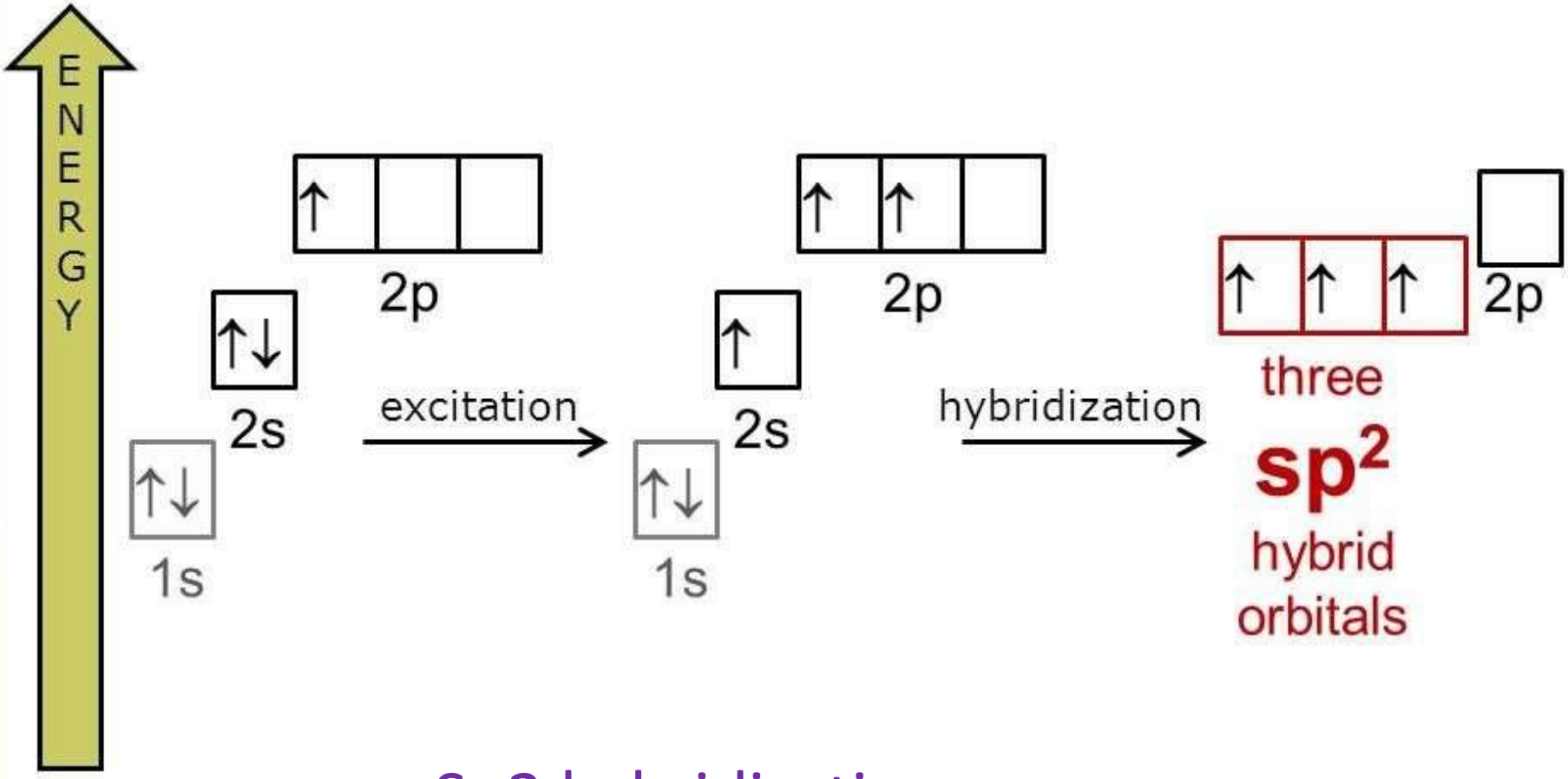


BF_3

B

$1s^2\underline{2s^2 2p^1}$





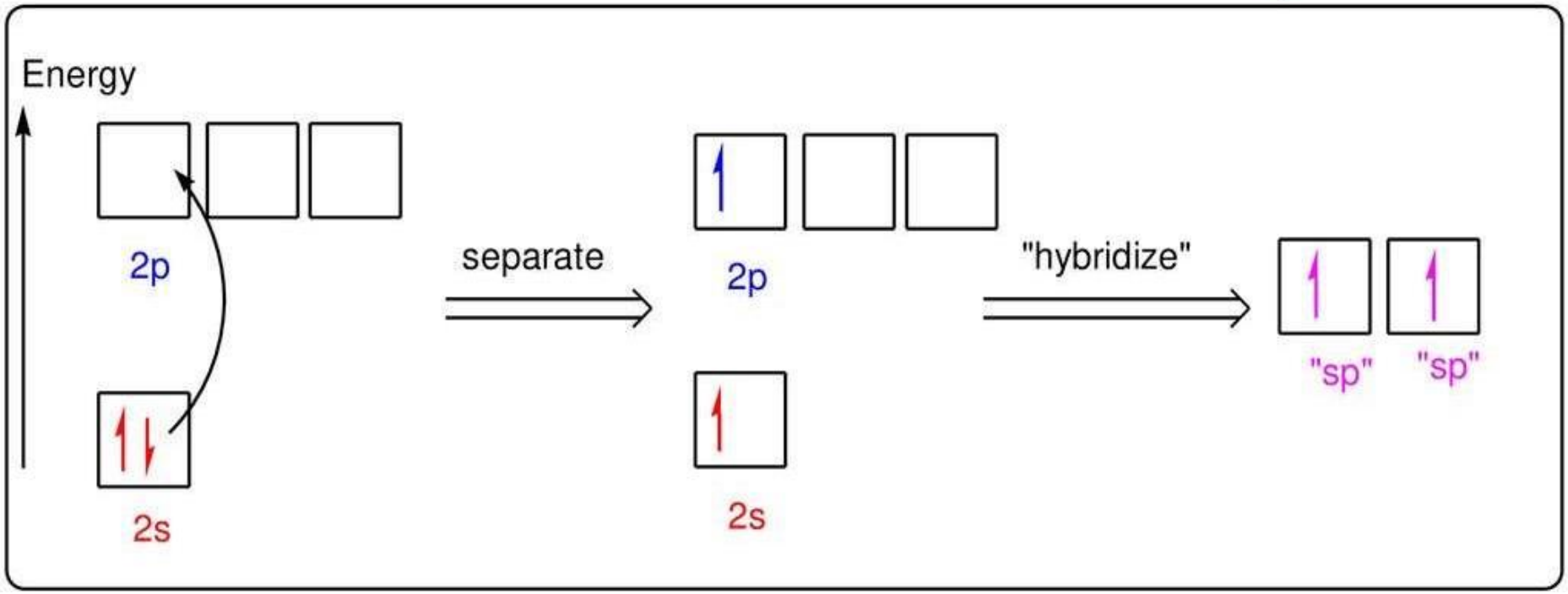
Sp2 hybridization

Hybridization of Be in $BeCl_2$

Valence e's

Atomic Be 4: $1s^2\ 2s^2$

Hybrid sp orbitals:
1 part s, 1 part p

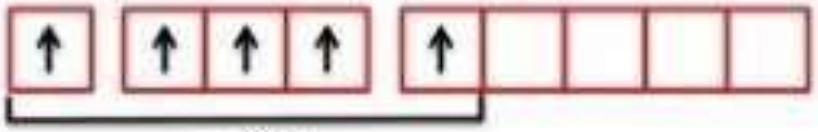


Sp hybridization

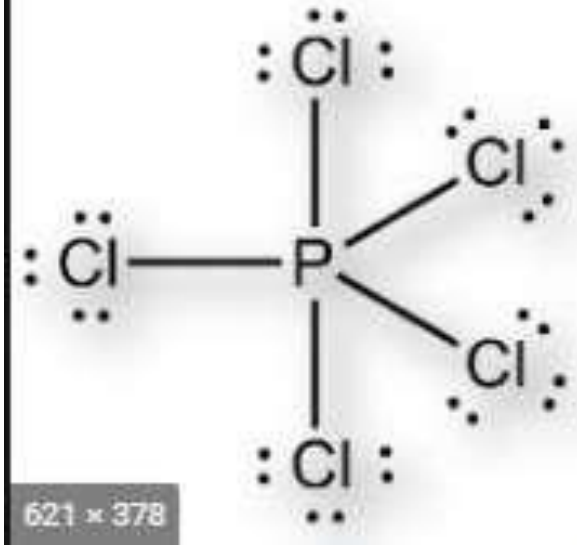
One ‘s’, three ‘p’ and one ‘d’ orbitals of same shell participates to give sp^3d hybd. with trigonal bipyramidal shape with bond angles 90° &120°. **Example:** PF_5 & PCl_5,

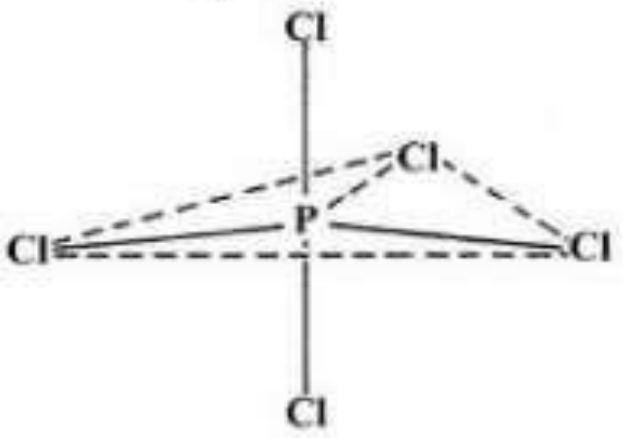
P(G.S.) = $1s^2 2s^2 2p^6 3s^2 3p^3$

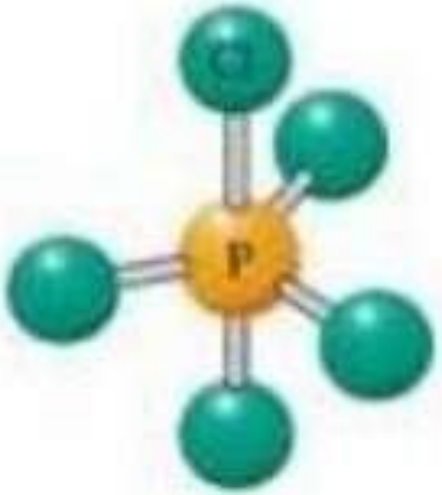
P(E.S.) = $1s^2 2s^2 2p^6 3s^1$ $3p^3$ $3d^1$



sp^3d

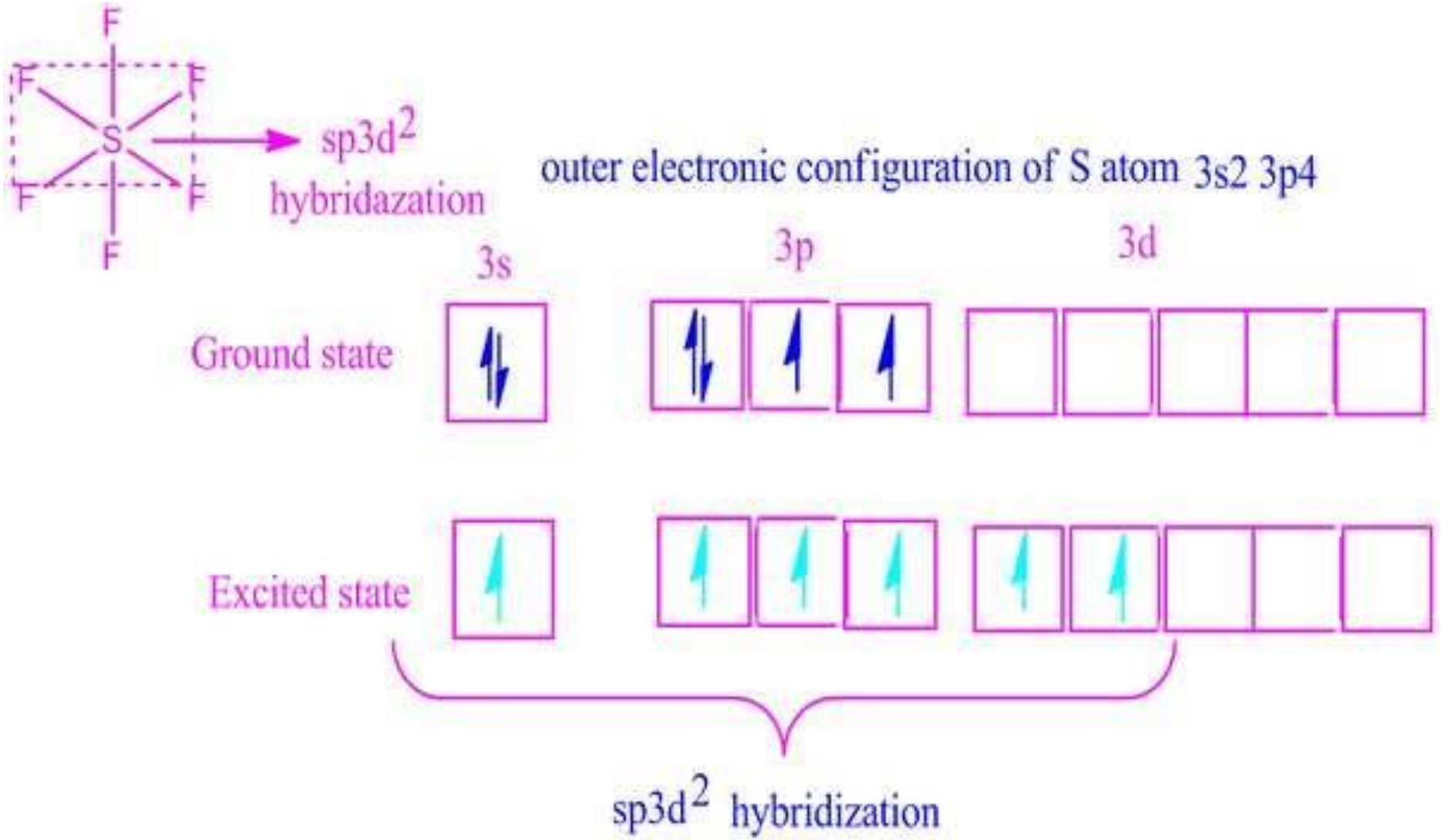






621 × 378

Sp3d hybridization



Sp3d2 hybridization

(2) Octahedral complex :- (Inner orbital)

The complex $[Co(NH_3)_6]^{3+}$ diamagnetic The central metal cobalt is in tripositive Oxidation state.

E.C. of Co $\Rightarrow 3d^7 4s^2$

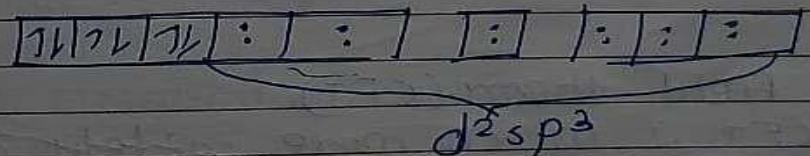
$\therefore$ E.C. of $Co^{+3} \Rightarrow 3d^6 4s^0$

$\therefore$ The Co^{+3} belongs to d^6 system and it is diamagnetic. No unpaired electron present in it. Now these six d-electrons are arranged among the 3d level in such a way that no unpaired e⁻ is present.

$\therefore$

$\therefore$ The coordination no. of complex is six then the next six higher vacant orbitals are used for hybridisation.

$\therefore$



This corresponds to d^2sp^3 hybridisation having geometry Octahedral. More specifically it is called as, inner-orbital complex. Second example of inner orbital complex is $[Fe(CN)_6]^{4-}$