Chemistry - 101

The valence is the number of electron pairs that binds the atom with other atoms

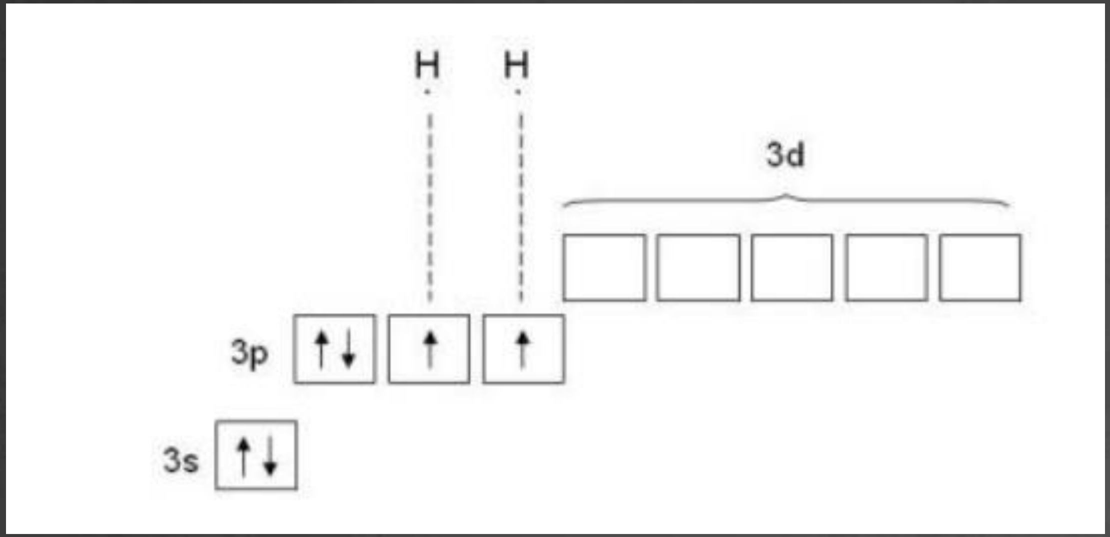
Element	Valence	Element	Valence
H	I	Ba	II
Na	I	O	II
K	I	Zn	II
Ag	I	Sn	II (IV)
F	I	Pb	II (IV)
Cl	I (III, V, VII)	Fe	II, III
Br	I (III, V, VII)	Cr	III, VI
I	I (III, V, VII)	S	II, IV, VI
Hg	I, II	Al	III
Cu	I, II	N	III (IV)
Be	II	P	III, V
Mg	II	C	IV
Ca	II	Si	IV (II)

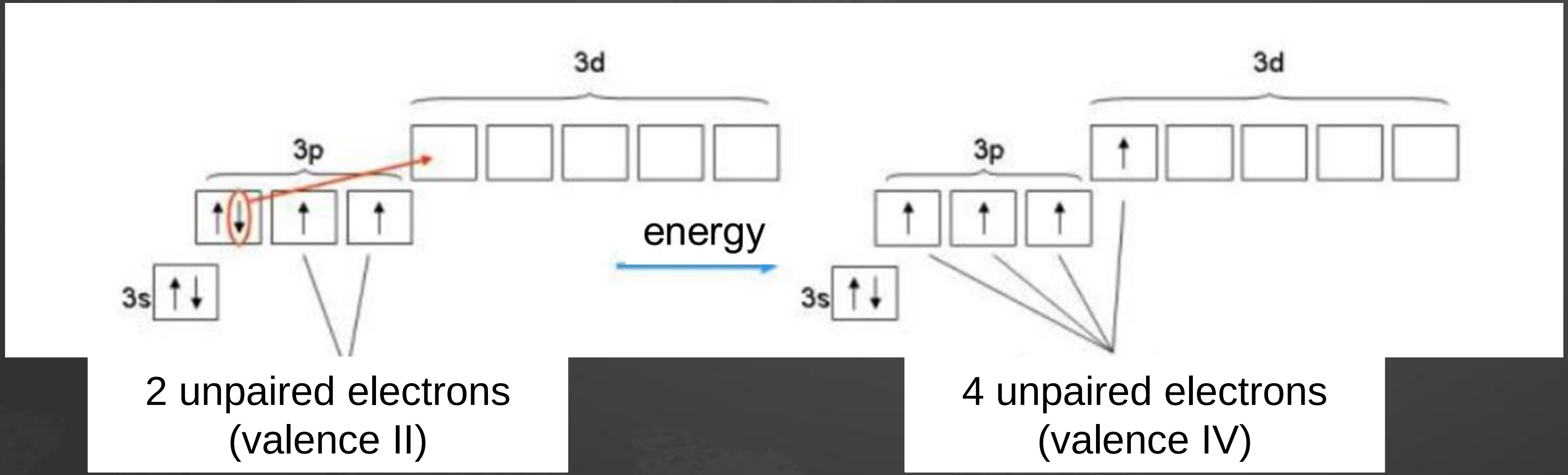
Let's consider $_{16}S$

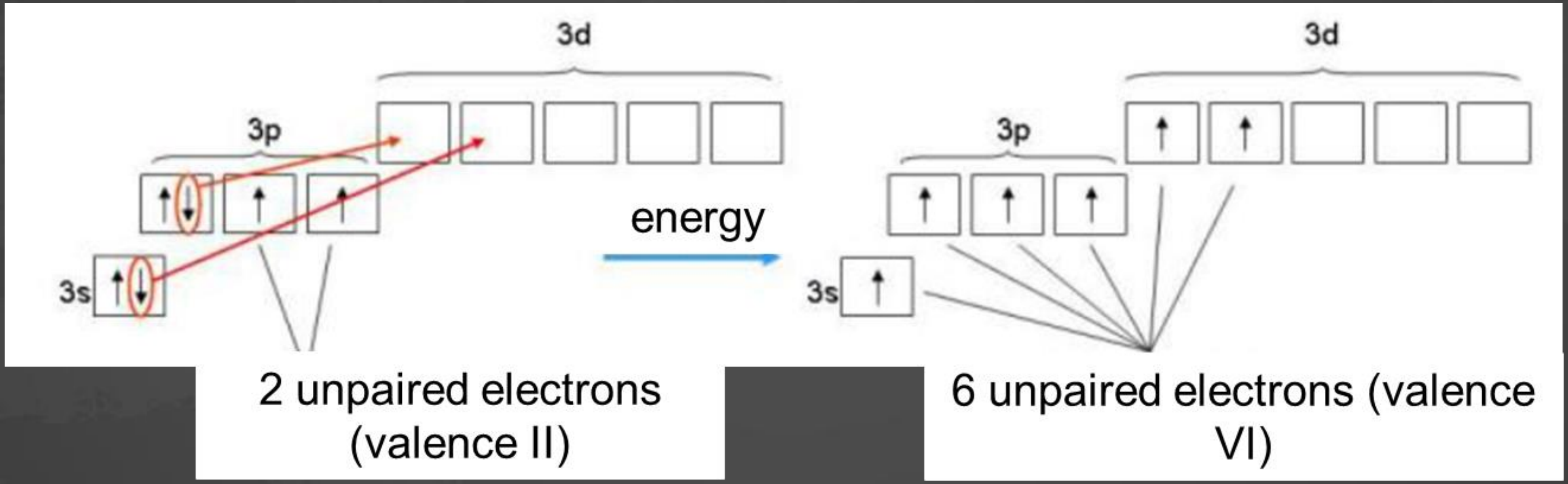
$2H + S = H_2S$

$2O + S = SO_2$

$3O + S = SO_3$






3d
3p
3s
energy
3d
3p
3s
2 unpaired electrons (valence II)
6 unpaired electrons (valence VI)

The oxidation state, which may be positive, negative or zero, is the hypothetical charge that an atom would have if all bonds to atoms of different elements were 100% ionic, with no covalent component.

Element	Electronegativity	Element	Electronegativity
Cs	0.79	H	2.20
K	0.82	C	2.55
Na	0.93	S	2.58
Li	0.98	I	2.66
Ca	1.00	Br	2.96
Mg	1.31	N	3.04
Be	1.57	Cl	3.16
Si	1.90	O	3.44
B	2.04	F	3.98
P	2.19		

Molecular geometry

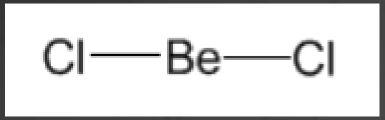
Valence shell electron pair repulsion (VSEPR) theory

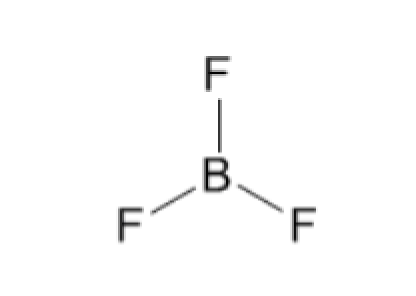
- Molecular geometry is the 3D arrangement of atoms within a molecule

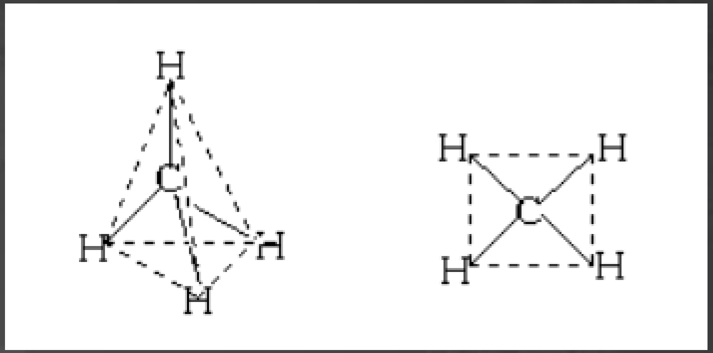
- Chemical bonds and unpaired electron pairs in a molecule repel, so they try to stay as far as possible from each other.

- The repulsion between unpaired electrons (u.e.) is stronger than repulsion between paired electrons (p.e.). The repulsion decreases in the row:

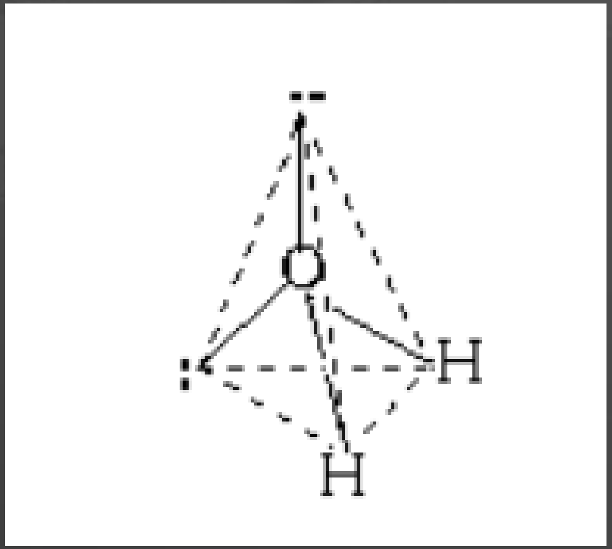
(u.e. / u.e. > u.e. / p.e. > p.e. /p.e.)



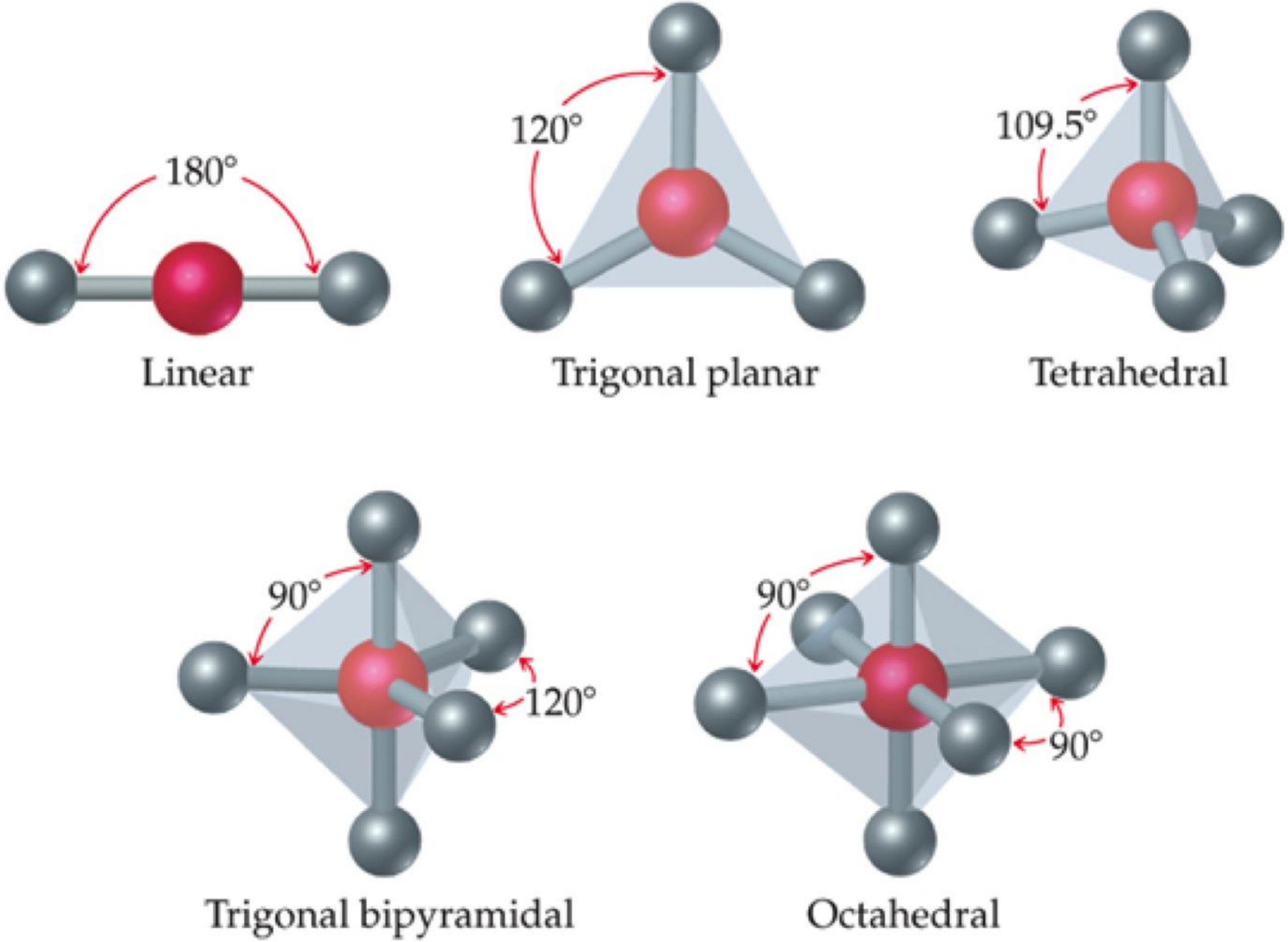


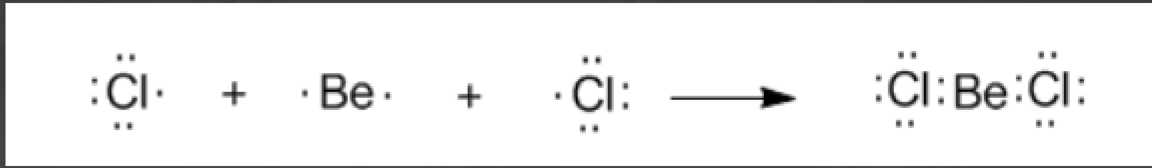


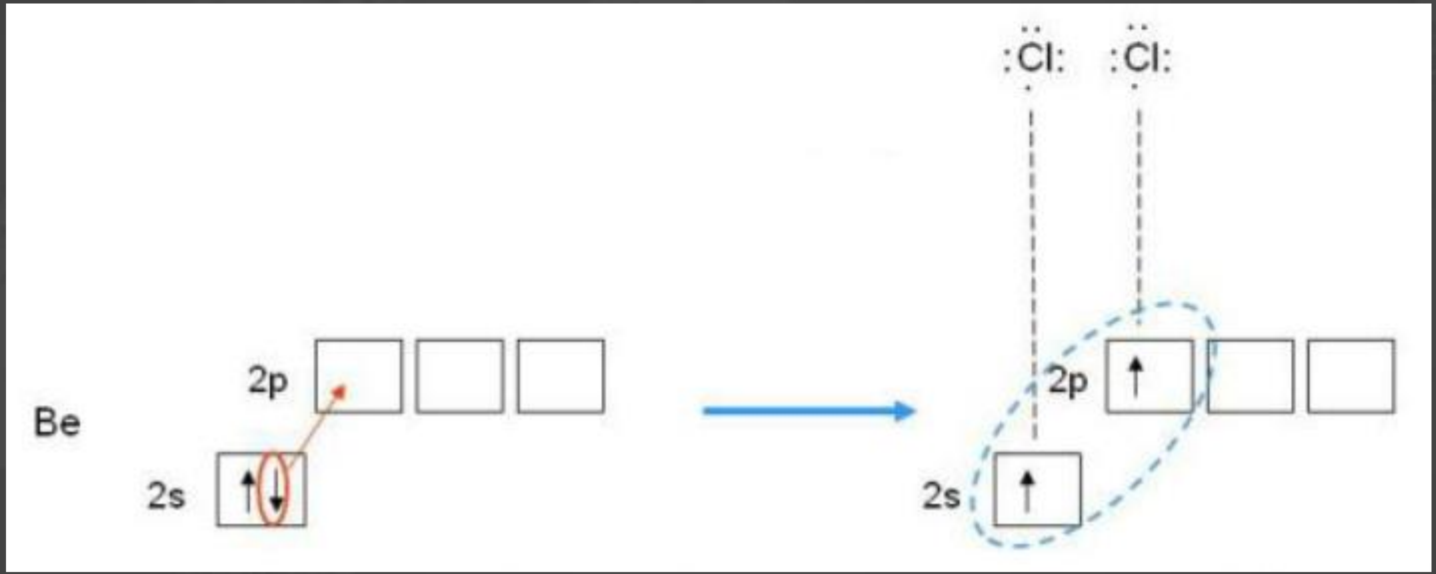
~109º

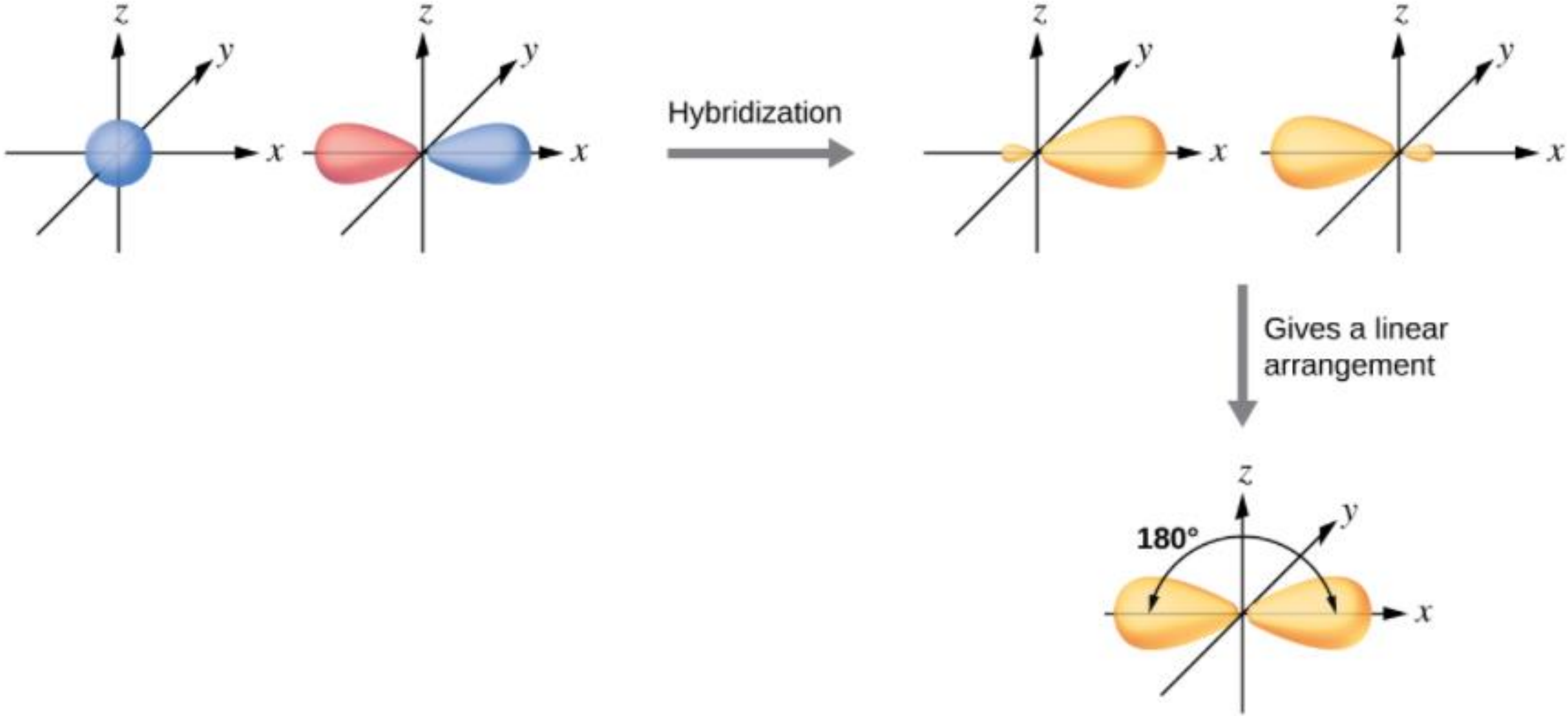


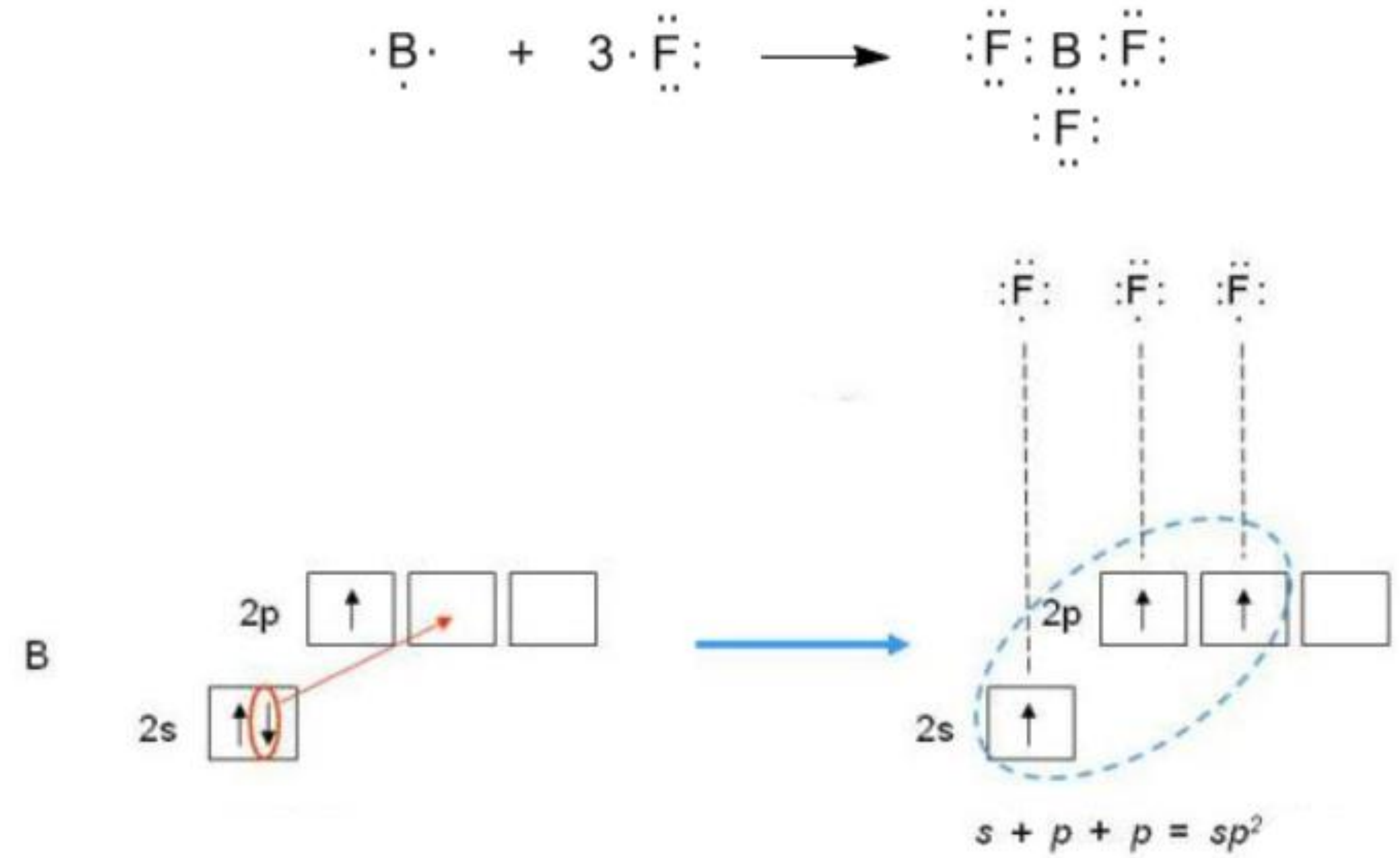
~105º

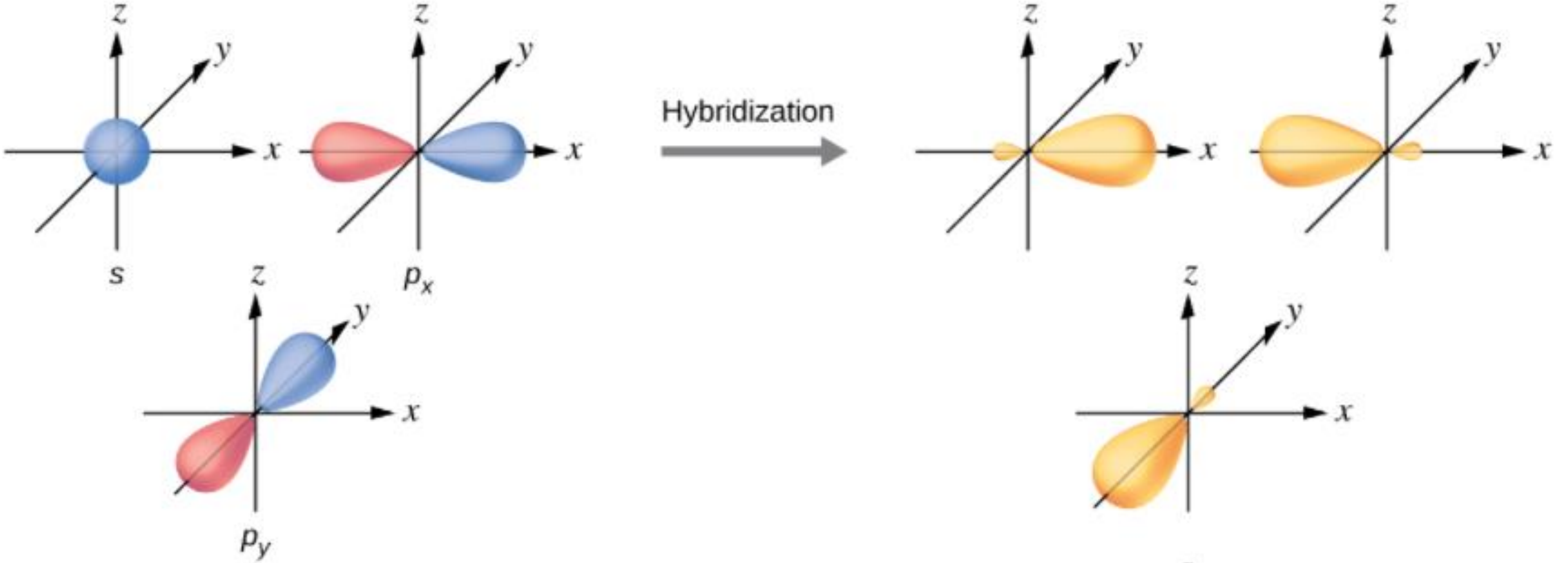

180°
Linear
120°
Trigonal planar
109.5°
Tetrahedral
90°
120°
Trigonal bipyramidal
90°
90°
Octahedral

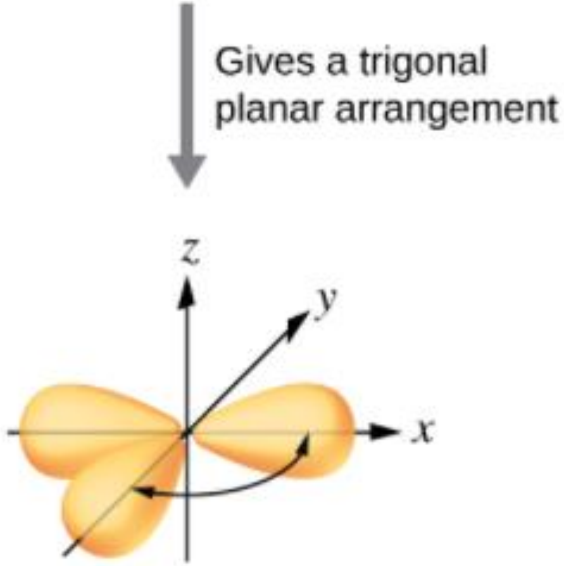

Cl + Be + Cl
ClBeCl


Cl
Cl
2p
Be
2s
2p
2s

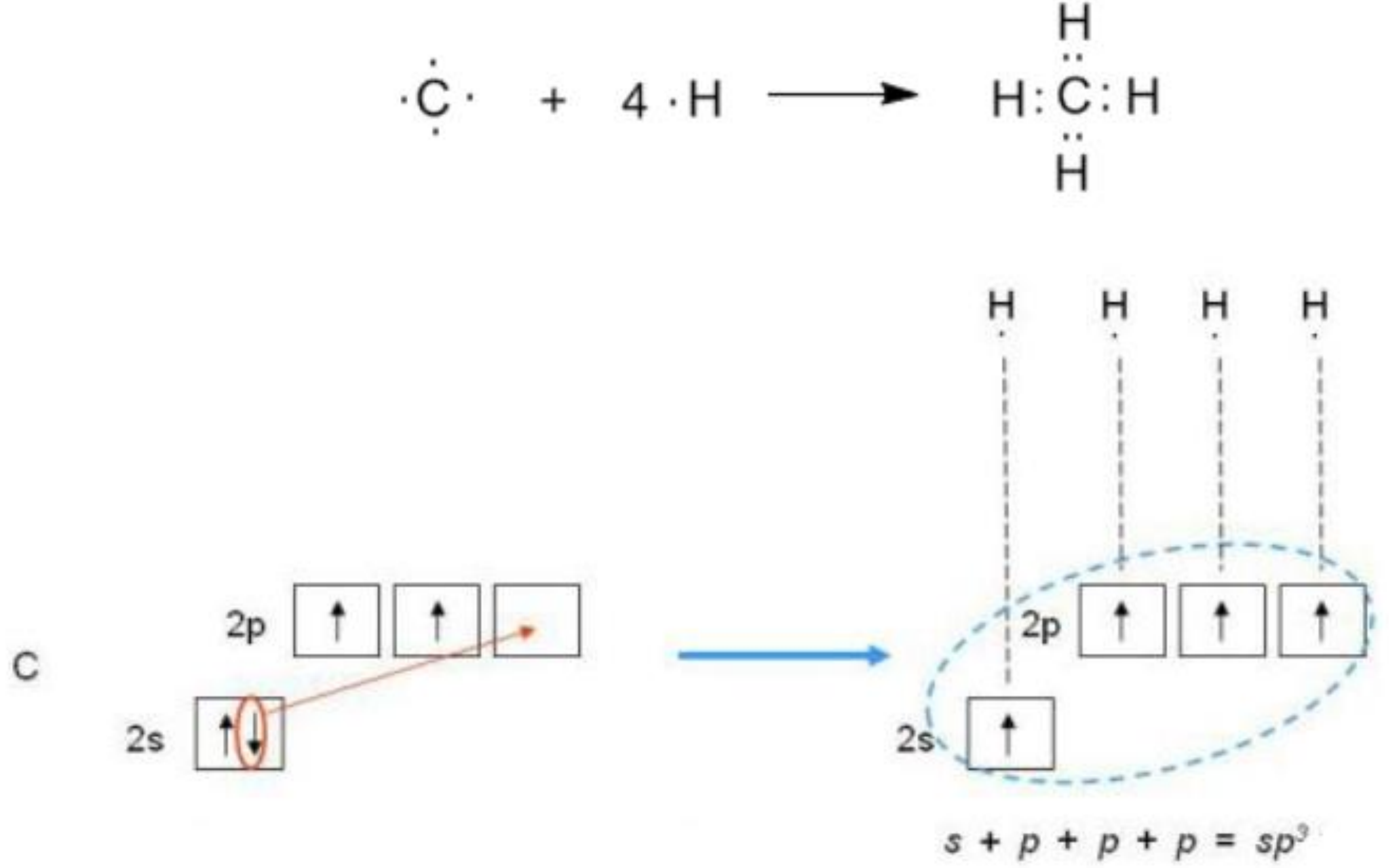

z
y
x
Hybridization
Gives a linear arrangement
180°


·B· + 3·F: → :F:B:F:
:F:
B
2p
2s
2p
2s
s + p + p = sp²

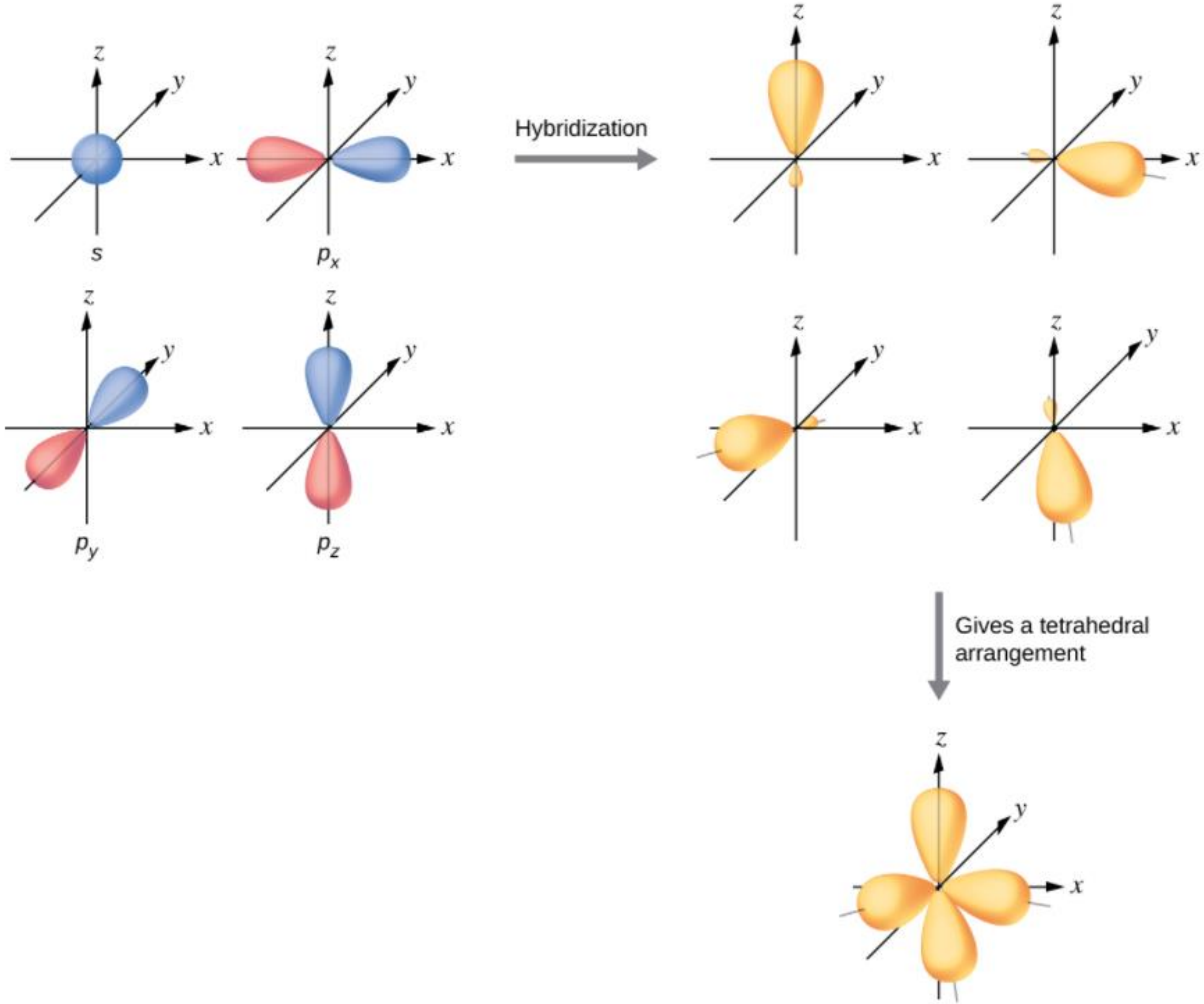




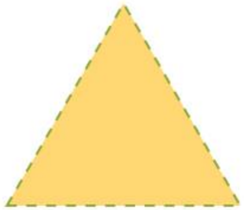
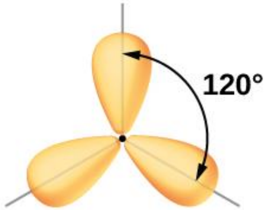
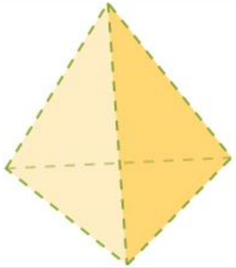
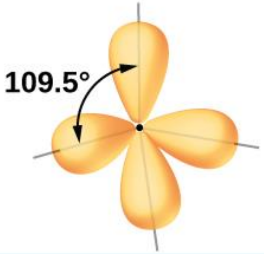
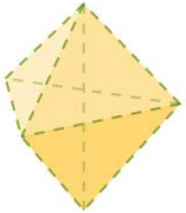
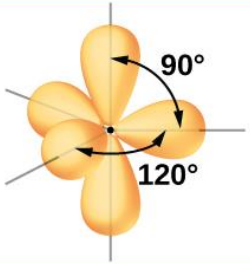
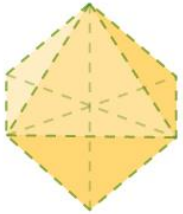
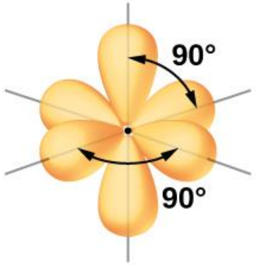
The number of hybrid orbitals is equal to the number of the original atomic orbitals.



·C· + 4 ·H → H:C:H
H
H
C
2s
2p
H H H H
2s
2p
s + p + p + p = sp3



s
p_x
p_y
p_z
Hybridization
Gives a tetrahedral arrangement

Regions of Electron Density	Arrangement		Hybridization	
2		linear	*sp*	
3		trigonal planar	sp^2	
4		tetrahedral	sp^3	
5		trigonal bipyramidal	sp^3d	
6		octahedral	sp^3d^2	

This class uses the materials from the following books:
Larry Gonick and Graig Criddle “The cartoon guide to chemistry”
Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”