

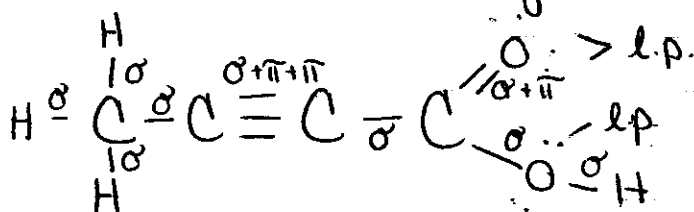
★ Molecular Architecture Unit ★

Valence Shell Electron Pair Repulsion Theory and
Cool Lewis Dot Diagrams that can be Used to Explain
Polyatomic Ions!

Band Types :

1. σ (sigma) bond \rightarrow simple single bond.
2. π (pi) bond \rightarrow second bond in a double bond or second and third bond in a triple bond.

lone pair (non-bonding pair) - σ (like in nature).



- σ bonds and lone pairs are dense and count
- π bonds diffuse and don't count \rightarrow ignore them!
 \hookrightarrow no effect on shape!

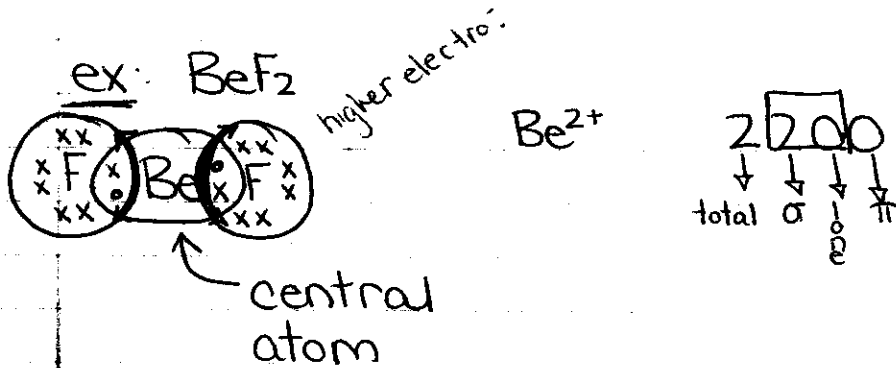
Bonding Rules:

- ① Halogens always get their way \rightarrow Form simple ~~single~~ single covalent bonds even if the octet rule is disobeyed!
- ② Extra Electrons - account for ionic charge (ex CO_3^{2-} has 2 extra electrons) \rightarrow always located on the most electronegative element present \Rightarrow oxygen (use a separate symbol).
- ③ Oxygen - will produce satisfied octets around the central atom using:
 - a) halogens & like single bonds

- b) double bonds (adds two electrons).
- c) coordinate covalent bonds* (main valence electrons).

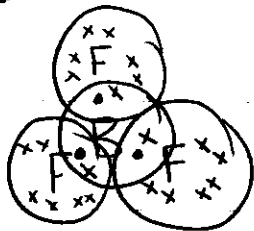
Coordinate Covalent Bond

- ↳ uneven sharing
- one atom contributes both bonding electrons.



base shape = linear
 actual shape = linear
 bond angle = 180° .

ex2: BF_3



B^{3+}

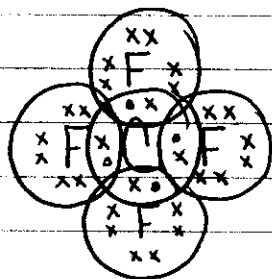
$3|3|0|0$

↳ trigonal planar

bond angle = 120° .

↑ (Fluorine gets its way)

ex3: CF_4

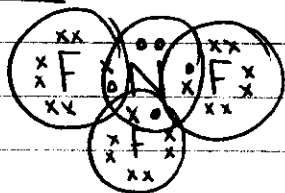


$\text{C}4+$

4400

tetrahedral.
bond angle = 109.5°

ex4: NF_3

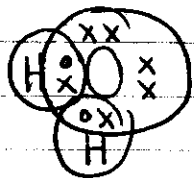


$\text{N}3+$

4310

base shape = tetrahedral (3+1)
actual shape = pyramidal
Bond angle = 109.5°

ex5: H_2O

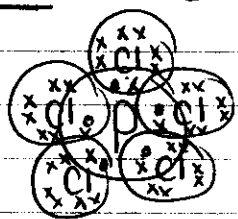


$\text{O}2-$ (gains $2e^-$)

4220

base shape = tetrahedral
actual shape = angular
bond angle = $< 109.5^\circ$ (104.5°)

ex6: PCl_5

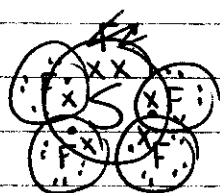


P^{5+}

5500

trigonal bipyramidal
bond angle = $90^\circ, 120^\circ$

ex7: SF_4

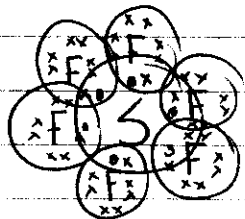


S^{4+}

5410

trigonal bipyramidal
see-saw - $\approx 90^\circ + 120^\circ$

ex8: SF_6

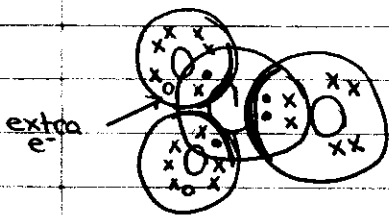


S^{6+}

6600

octahedral
bond angle = 90°

* No Halogen ex9: CO_3^{2-}

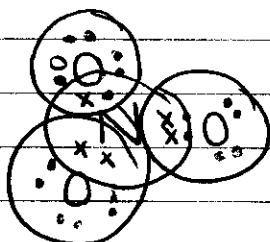


C^{4+}

4301

trigonal planar
bond angle $\approx 120^\circ$

ex10: NO_3^-

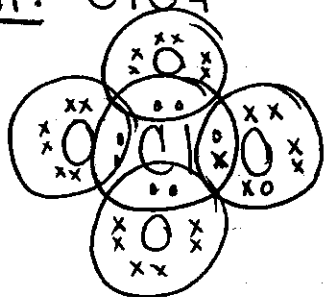


N^{5+}

4301

trigonal planar
 $\angle \approx 120^\circ$

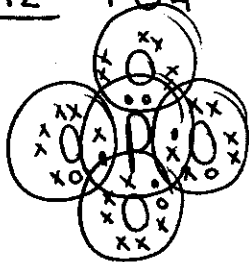
ex11: ClO_4^{1-}



Cl^{7+}

4400
tetrahedral
 $\angle = 109.5^\circ$

ex12: PO_4^{3-}



P^{5+}

4400
tetrahedral
bond $< 109.5^\circ$