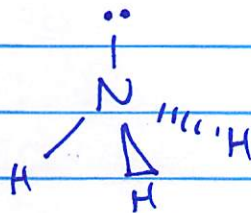
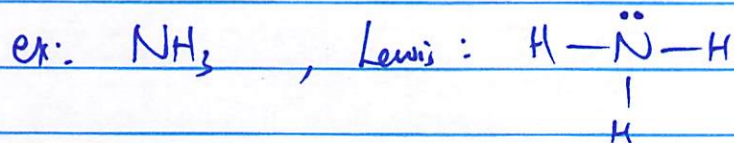
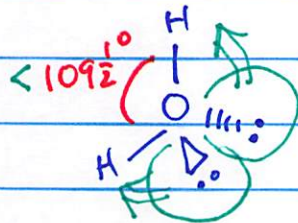
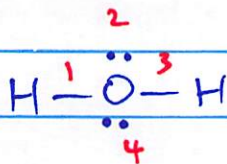
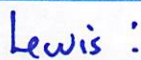
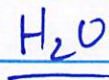


VSEPR

e^- geom: where e^- s are
molecular geometry: where atoms are!!



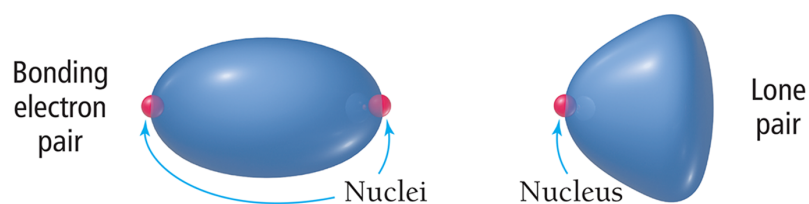
e^- geom: tetrahedral
mol geom: trigonal
pyramidal.



e^- geom: tetrahedral
mol. geom: BENT

water: 104.5°

Effect of Lone Pairs



The bonding electrons are attracted to two nuclei whereas a lone pair is attracted to only one nucleus. The nonbonding electrons are localized on the central atom, so the area of negative charge takes more space.

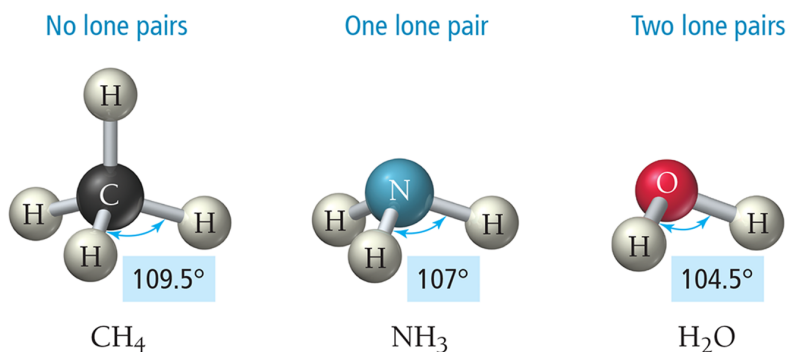


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27

Bond Angle Distortion from Lone Pairs (1 of 3)

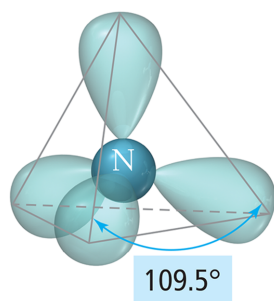
Effect of Lone Pairs on Molecular Geometry



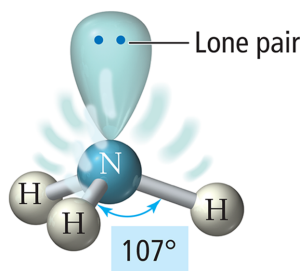
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28

Bond Angle Distortion from Lone Pairs (2 of 3)

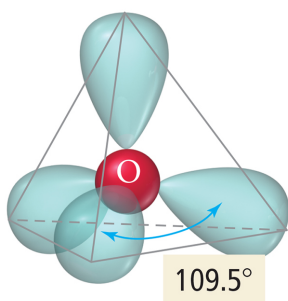


Ideal tetrahedral geometry

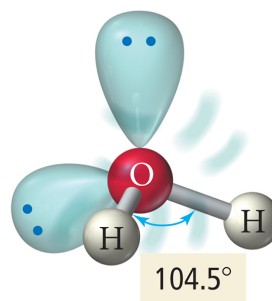


Actual molecular geometry

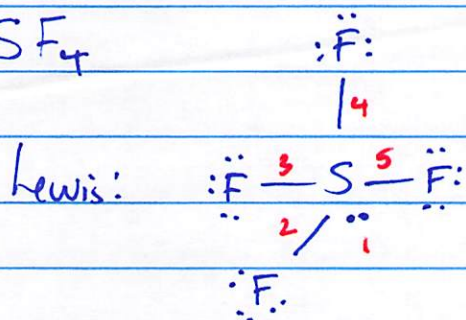
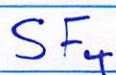
Bond Angle Distortion from Lone Pairs (3 of 3)



Ideal tetrahedral geometry

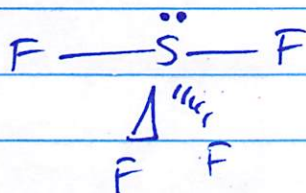
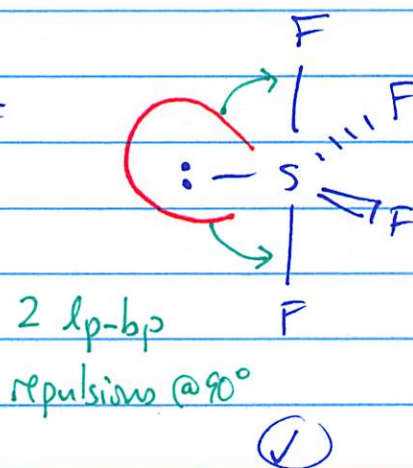
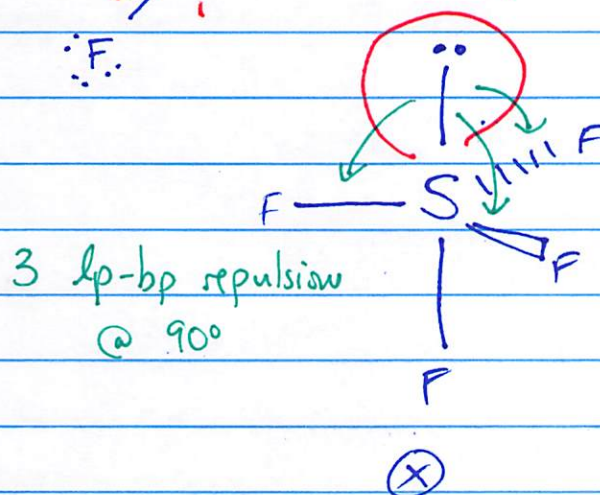


Actual molecular geometry

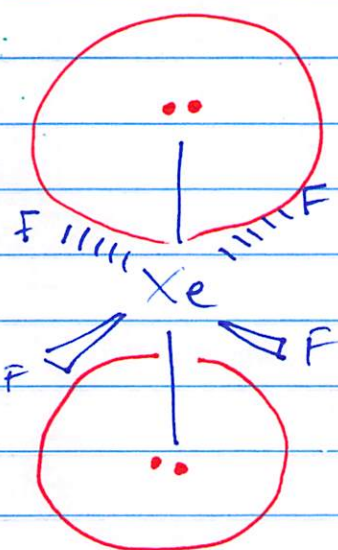
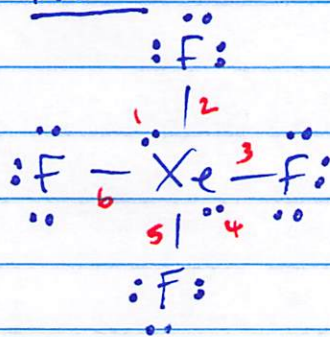
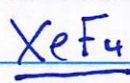


5 rep

- trigonal bipyramidal e^- geom.



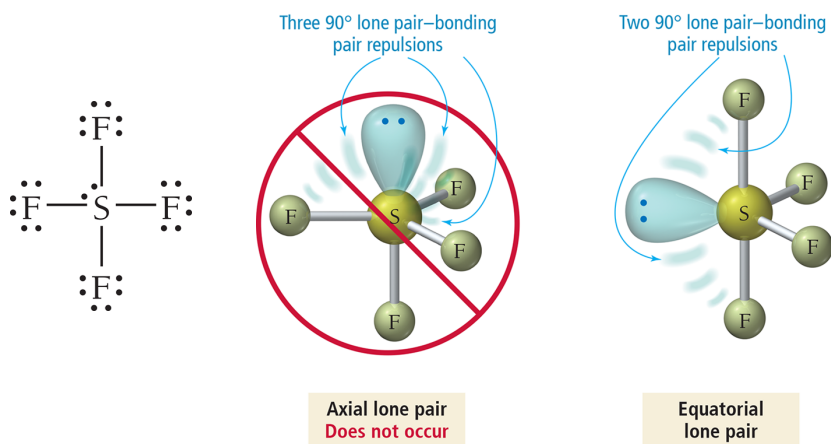
mol geom: see-saw



e^- geom
octahedral

mol. geom
square planar

Seesaw

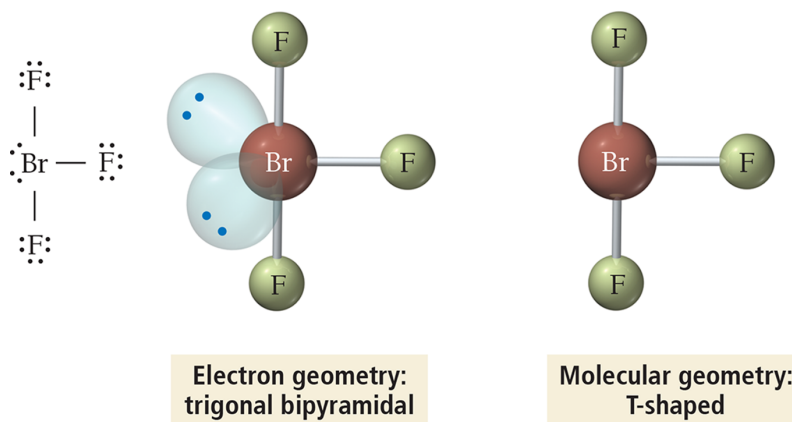


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34

T-Shape

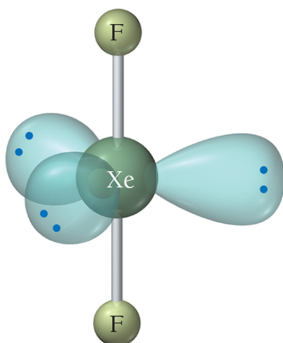
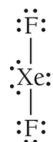


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35

Linear



Electron geometry:
trigonal bipyramidal



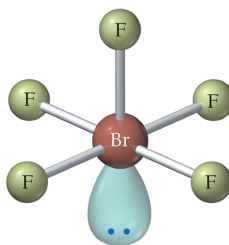
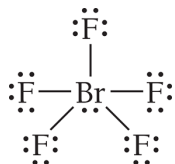
Molecular geometry:
linear



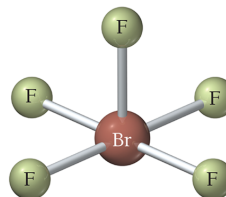
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36

Square Pyramidal



Electron geometry:
octahedral



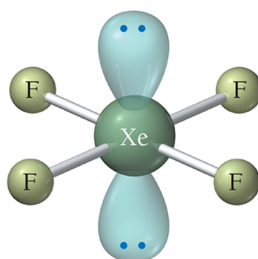
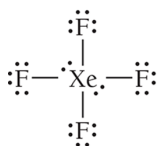
Molecular geometry:
square pyramidal



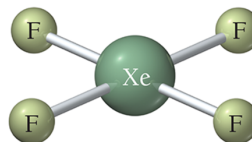
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38

Square Planar

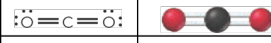
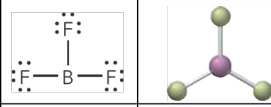
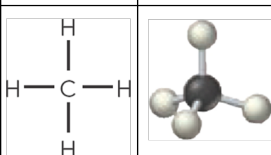


Electron geometry:
octahedral



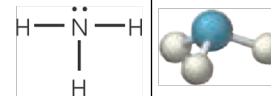
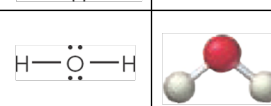
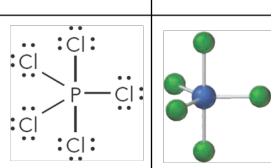
Molecular geometry:
square planar

Electron and Molecular Geometries (1 of 4)

Electron Groups*	Bonding Groups	Lone Pairs	Electron Geometry	Molecular Geometry	Approximate Bond Angles	Example
2	2	0	Linear	Linear	180°	
3	3	0	Trigonal planar	Trigonal planar	120°	
3	2	1	Trigonal planar	Bent	<120°	
4	4	0	Tetrahedral	Tetrahedral	109.5°	

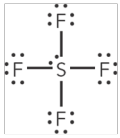
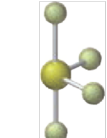
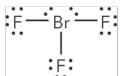
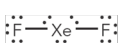
40

Electron and Molecular Geometries (2 of 4)

Electron Groups*	Bonding Groups	Lone Pairs	Electron Geometry	Molecular Geometry	Approximate Bond Angles	Example
4	3	1	Tetrahedral	Trigonal pyramidal	<109.5°	
4	2	2	Tetrahedral	Bent	<109.5°	
5	5	0	Trigonal bipyramidal	Trigonal bipyramidal	120° (equatorial) 90° (axial)	

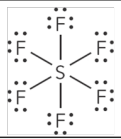
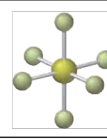
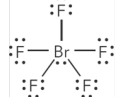
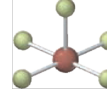
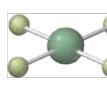
41

Electron and Molecular Geometries (3 of 4)

Electron Groups*	Bonding Groups	Lone Pairs	Electron Geometry	Molecular Geometry	Approximate Bond Angles	Blank Example
5	4	1	Trigonal bipyramidal	Seesaw	$<120^\circ$ (equatorial) $<90^\circ$ (axial)	 
5	3	2	Trigonal bipyramidal	T-shaped	$<90^\circ$	 
5	2	3	Trigonal bipyramidal	Linear	180°	 

42

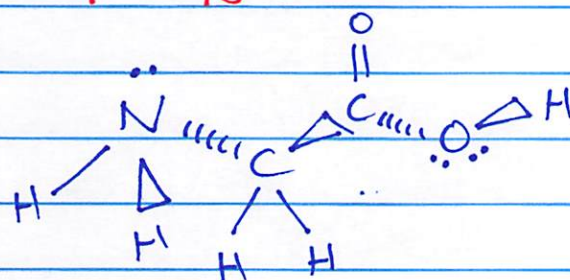
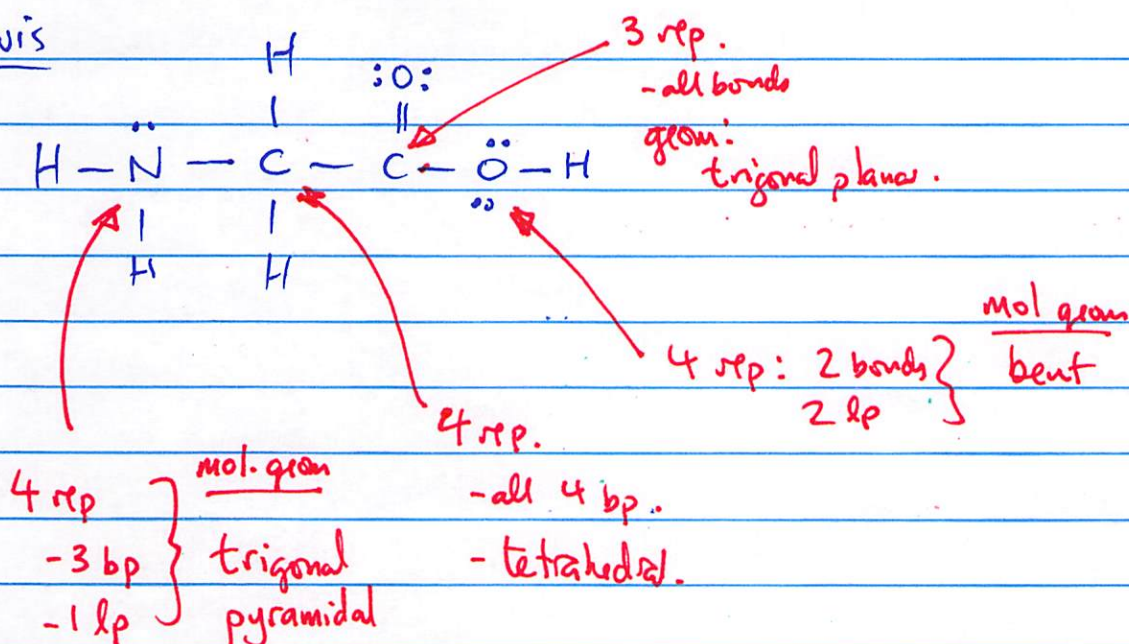
Electron and Molecular Geometries (4 of 4)

Electron Groups*	Bonding Groups	Lone Pairs	Electron Geometry	Molecular Geometry	Approximate Bond Angles	Blank Example
6	6	0	Octahedral	Octahedral	90°	 
6	5	1	Octahedral	Square pyramidal	$<90^\circ$	 
6	4	2	Octahedral	Square planar	90°	 

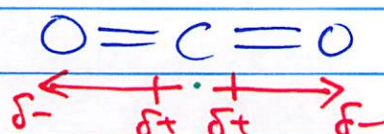
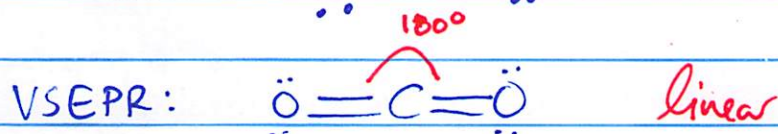
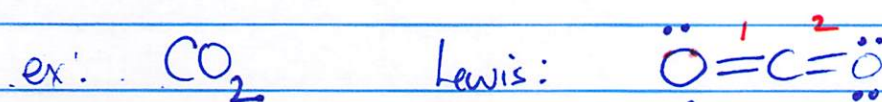
*Count only electron groups around the central atom. Each of the following is considered one electron group: a lone pair, a single bond, a double bond, a triple bond, or a single electron.

43

Lewis



Molecular shape + polarity

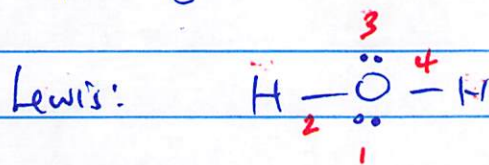


↑ = bond dipole

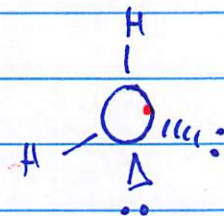
overall dipole? = $\sum$ bond dipoles.

overall dipole = 0 $\mu = 0$ (everything cancels)
 NON-POLAR

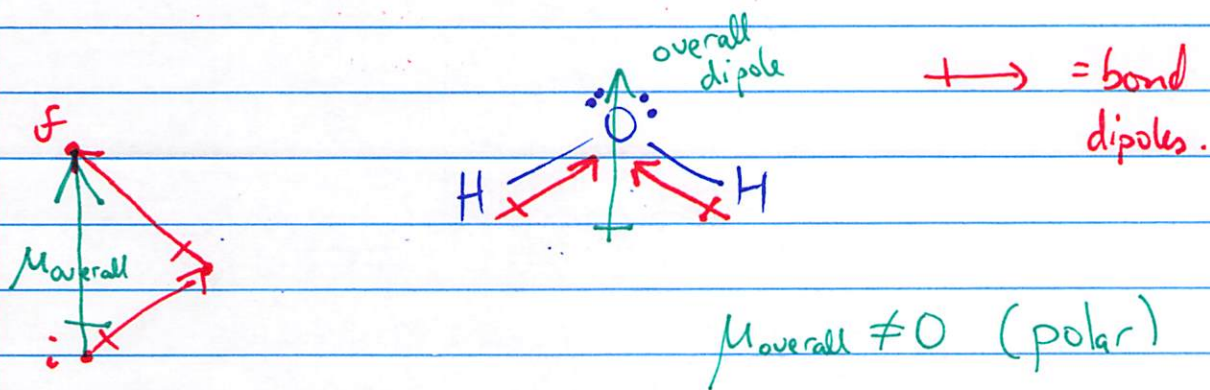
H₂O - polarity?



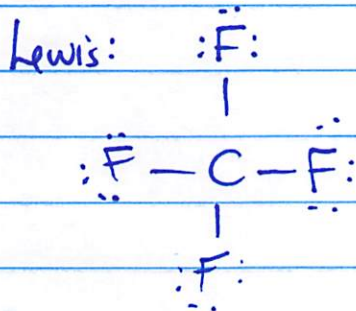
VSEPR:



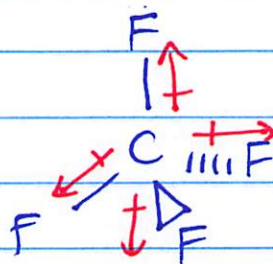
mol geom = bent.



CF₄



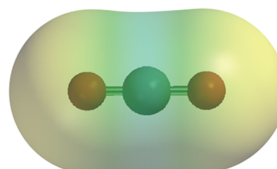
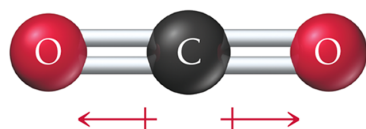
VSEPR:



Moverall = 0 NON-POLAR!

Molecular Polarity (2 of 2)

No net dipole moment



The O — C bond is polar. The bonding electrons are pulled equally toward both O ends of the molecule. The net result is a nonpolar molecule.

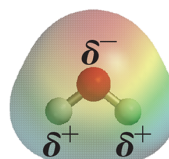
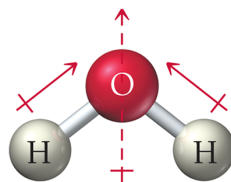


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59

Molecular Shape and Polarity

Net dipole moment



The H — O bond is polar. Both sets of bonding electrons are pulled toward the O end of the molecule. Because the molecule is **bent**, not linear, the net result is a polar molecule.



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60