

BOND ANGLES

NAME _____

SECTION _____

1. a. Estimate the O–C–O bond angle in the following molecules, in which the central atom is carbon and the terminal atoms are oxygen.

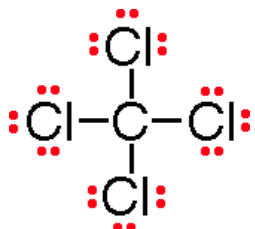


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- b. Write the formula for each species depicted above.

The model on the left is CO₂, while the model on the right is CO₃²⁻.

2. a. Draw the Lewis electron dot structure for CCl₄ and identify all the bonding pairs and nonbonding pairs of electrons on the central atom.

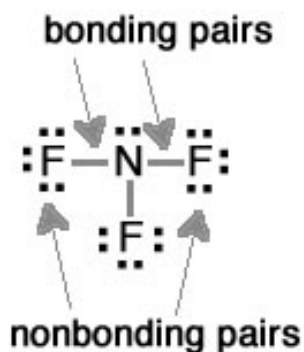


In the image to the left the covalent bonds between carbon and chlorine are depicted as lines and the lone pair electrons on chlorine are depicted as red circles, where each circle symbolizes an electron. Given this information answer the following questions. The central carbon atom has four bonding domains and zero nonbonding domains of electrons.

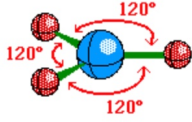
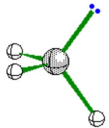
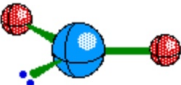
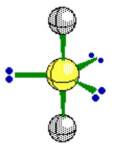
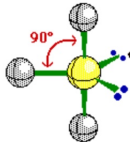
- b. What is the Cl–C–Cl bond angle?

The Cl–C–Cl bond angle is 109.5°. While it looks like it is 90°, central atoms with four domains of electrons are 109.5°.

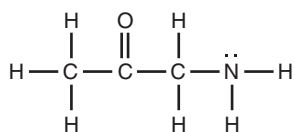
3. Draw the Lewis electron dot structure for NF₃ and identify all the bonding pairs and nonbonding pairs of electrons.



4. Complete the following table:

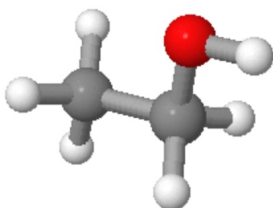
Sketch Geometry	Compound	Number of Bonding Groups on Central Atom	Number of Non-bonding Pairs on Central Atom	Name of the Molecular Geometry	Bond Angle(s)
	SO ₃	3	0	trigonal planar	120°
	SO ₃ ²⁻	3	1	Trigonal pyramidal	109.5°
	NO ₂ ⁻	2	1	bent	120°
	I ₃ ⁻	2	3	linear	180°
	ICl ₃	3	2	T-shaped	90°, 180°

5. Indicate the geometry about each of the “central atoms” in the molecule shown below.



The 'C' atom on the left side of the molecule is tetrahedral (bonded to three 'H' atoms), the 'C' atom (bonded to the 'O' atom) is trigonal planar, and the 'C' atom (bonded to two 'H' atoms) is tetrahedral.

6. Indicate the geometry about each of the “central atoms” in the molecule CH₃CH₂OH.



There are three 'central' atoms, the two carbon atoms (grey), and the one oxygen atom (red). Each of the carbon atoms is tetrahedral, and the oxygen atom is bent. NOTE: in the model on the left the two sets of lone-pair electrons are not shown. Ethanol has a total of 20 valence electrons. Sixteen of the twenty electrons are needed for covalent bonds (five C-H bonds, one C-C bond, one C-O bond and one O-H bond) and four electrons for two lone-pairs on the oxygen atom.