

Chemistry – Chapter 12: Chemical Bonding

Name: Key Date: _____ Period: _____

1. In 1916, Gilbert Newton Lewis noted that noble gases were unusually stable. With the exception of helium, which has 2 electrons in its outer shell, all of the rest have 8 electrons. This is known as the octet rule.

2. Define valence electrons: The outermost energy (s and p electrons) level electrons in an atom.

3. Valence electrons are responsible for chemical bonding.

4. In an ionic compound, one or more valence electrons are transferred between atoms, whereas in a covalent compound, one or more valence electrons of an atom are shared between atoms.

5. The fundamental particle of an ionic compound is known as a formula unit. The fundamental particle of a covalent compound is known as a molecule.

6. The electronegativity of an atom gives the relative tendency for that atom to draw electrons

towards it in a chemical bond. Between two atoms, the difference in this number determines the bond character or polarity of the bond. This scale was developed by the chemist Linus Pauling.

7. When deciding on an appropriate dot structure for a molecule, the less electronegative atom is usually in the center. One important exception to this is hydrogen which must always be an outer or terminal atom.

8. When a molecule has resonance, two or more equivalent ways of writing a dot structure are possible.

9. A particularly strong polar bond is known as hydrogen bonding. It occurs when hydrogen is connected to nitrogen, oxygen or fluorine.

10. Two things can make a molecule nonpolar: 1. Symmetrical arrangement of attached atoms.
and 2. Equal electronegativity values for the attached atoms.

Chemistry Activity – Molecular Geometry

On the back of this page, determine the appropriate Lewis dot structure for the listed molecules or ions and then construct them using the simulation at <http://phet.colorado.edu/en/simulation/molecule-shapes>. Sketch the species as constructed in the simulation and then fill out the remainder of the table.

Species	Lewis Dot Structure	Sketch of Model	Total number of valence electrons available	Bonding vs. non-bonding Electron Pairs (on central atom)	Electron Pair Geometry	Molecular Shape	Resonance? Yes/No	Polar?
1. NH ₃	$\begin{array}{c} \bullet\bullet \\ \\ \text{H}-\text{N}-\text{H} \\ \\ \text{H} \end{array}$		8	3/1	Tetrahedral	Trigonal Pyramidal	No	Yes
2. AsF ₃	$\begin{array}{c} \bullet\bullet \\ \\ \text{F}-\text{As}-\text{F} \\ \\ \text{F} \end{array}$		26	3/1	tetrahedral	Trigonal Pyramidal	No	yes
3. NOF (N in middle)	$\begin{array}{c} \bullet\bullet \\ \\ \text{F}-\text{N}=\text{O} \\ \\ \bullet\bullet \end{array}$		18	3/1	trigonal planar	bent	No	yes
4. CO ₂	$\text{O}=\text{C}=\text{O}$		16	4/0	linear	linear	yes	NO
5. ClO ₂ ⁻	$[\text{O}=\text{Cl}-\text{O}]^-$		20	2/2	tetrahedral	bent	No	yes
6. HCN	$\text{H}-\text{C}\equiv\text{N}:$		10	4/0	linear	linear	No	yes
7. CH ₂ O (C in middle)	$\begin{array}{c} \bullet\bullet \\ \\ \text{H}-\text{C}-\text{H} \end{array}$		12	4/0	trigonal planar	trigonal planar	No	yes
8. PI ₃	$\begin{array}{c} \bullet\bullet \\ \\ \text{I}-\text{P}-\text{I} \\ \\ \text{I} \end{array}$		26	3/1	tetrahedral	trigonal pyramidal	No	yes
9. SO ₂	$\text{O}=\text{S}-\text{O}:$		18	3/1	trigonal planar	bent	yes	yes
10. H ₂ O	$\text{H}-\text{O}-\text{H}$		8	2/2	tetrahedral	bent	No	yes
11. NO ₃ ⁻	$[\text{O}=\text{N}(\text{O})_2]^-$		24	4/0	trigonal planar	trigonal planar	yes	NO