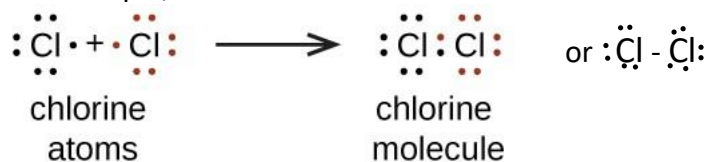


HW 7

Lewis structures, also known as Lewis dot diagrams, Lewis dot formulas, electron dot structures, or Lewis electron dot structures (LEDS), are diagrams that represent the bonding between atoms within a molecule, focusing exclusively on outer (valence) shell electrons. They illustrate electrons involved in bond formation, which are shared between atoms in covalent bonds, as well as non-bonding (lone) pairs of electrons present in the molecule.

In a Lewis structure, each atom is represented by its chemical symbol, with lines drawn between atoms to indicate bonds. (Pairs of dots may also be used to represent bonds instead of lines.) Lone pairs of electrons are shown as pairs of dots placed next to the relevant atoms.

For example, the Lewis structures for chlorine molecule (Cl_2) is:



Note that chlorine outer shell configuration is $\dots 3s^2 3p^5$. Each atom has 7 valence electrons, it includes 3 pairs of electrons, that are not going to be shared (lone pairs) and 1 electron that will be shared with other atom to form a chemical bond.

Structural formulas will show locations of chemical bonds between the atoms of a molecule.

They consist of symbols for the atoms connected by short line that represent chemical bonds (each short line represents 2 shared electrons):

Cl-Cl, H-H, Cl-Mg-Cl

When detailed information is not needed chemical formulas are used. In chemical formulas the number on the right of the element symbol shows how many atoms of this element is present in a molecule.

E.g. for Cl-Cl the chemical formula is Cl_2 , for Cl-Mg-Cl it is MgCl_2

When we write down Lewis structures for ionic compounds, you should remember the following: there are atoms that give away electron(s), and there are atoms that will accept electron(s), and we indicate corresponding charges on the atoms.

Sodium chloride, calcium fluoride and magnesium chloride compounds look like this:

Metal		Nonmetal		Ionic Compound
$\text{Na} \cdot$	+	$\begin{array}{c} \cdot\cdot \\ \text{Cl} \\ \cdot\cdot \\ \cdot \\ \text{Cl} \\ \cdot\cdot \\ \cdot\cdot \end{array}$	\longrightarrow	$\text{Na}^+ \left[\begin{array}{c} \cdot\cdot \\ \text{Cl} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right]^-$ sodium chloride (sodium ion and chloride ion)
$\cdot\text{Mg} \cdot$	+	$\begin{array}{c} \cdot\cdot \\ \text{O} \\ \cdot\cdot \\ \cdot \\ \text{O} \\ \cdot\cdot \\ \cdot\cdot \end{array}$	\longrightarrow	$\text{Mg}^{2+} \left[\begin{array}{c} \cdot\cdot \\ \text{O} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right]^{2-}$ magnesium oxide (magnesium ion and oxide ion)
$\cdot\text{Ca} \cdot$	+	$2 \begin{array}{c} \cdot\cdot \\ \text{F} \\ \cdot\cdot \\ \cdot \\ \text{F} \\ \cdot\cdot \\ \cdot\cdot \end{array}$	\longrightarrow	$\text{Ca}^{2+} \left[\begin{array}{c} \cdot\cdot \\ \text{F} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right]_2^-$ calcium fluoride (calcium ion and two fluoride ions)

Answer the following questions:

1. Based on the electron configurations of carbon (C, atomic number 6), hydrogen (H, atomic number 1), and the octet rule, write the Lewis formula for a compound containing one carbon atom and hydrogen atoms. Also, write its structural formula.
2. Write the symbols (including charge and its numeric value) for ions of sodium, oxygen, fluorine, magnesium, and aluminum that have the same electron configuration as the noble gas neon.
3. Write the Lewis formula for a compound containing one calcium atom (Ca, atomic number 20) and two bromine atoms (Br, atomic number 35). What is its structural formula?