

Guidelines for Writing Lewis Dot Structures for Molecules and Polyatomic Ions: (Modified and expanded from: Kroschwitz, Winokur and Lees, 1995)

1. Determine t , the sum of the number of electrons that each atom must have to satisfy the octet rule (or duet rule for H).

Example: For H_2O , $t = 8$ for Oxygen, $+ 2$ for Hydrogen, $+ 2$ for Hydrogen = 12

Example: For CO_2 , $t = 8$ for Carbon, $+ 8$ for Oxygen, $+ 8$ for Oxygen = 24

Example: For NH_4^+ , $t = 8$ for Nitrogen, $+ 4 \times 2$ for four Hydrogen = 16

2. Determine v , the sum of the number of valence electrons in each atom.

Example: For H_2O , $v = 6$ for Oxygen, $+ 1$ for Hydrogen, $+ 1$ for Hydrogen = 8

Example: For CO_2 , $v = 4$ for Carbon, $+ 6$ for Oxygen, $+ 6$ for Oxygen = 16

[Note: Subtract one from v for every positive charge or add one to v for every negative charge in a polyatomic ion.]

Example: For NH_4^+ , $v = 5$ for Nitrogen, $+ 4$ for four H, $- 1$ for charge = 8

3. Find the number of covalent bonds (b) in the molecule or polyatomic ion by using the equation $b = (t - v) / 2$. [Note: Each single covalent bond has two electrons.]

Example: For H_2O , $b = (12 - 8) / 2 = 2$

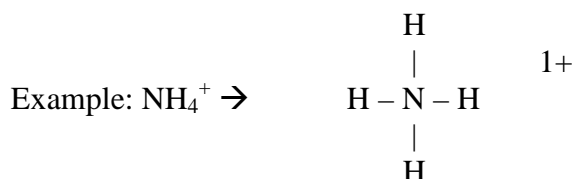
Example: For CO_2 , $b = (24 - 16) / 2 = 4$

Example: For NH_4^+ , $b = (16 - 8) / 2 = 4$

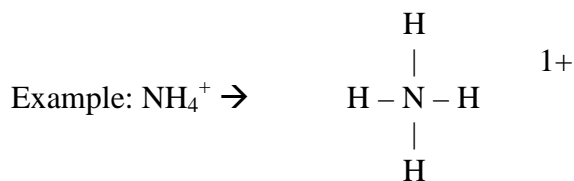
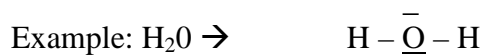
4. Identify the central atom in the molecule or polyatomic ion by considering the following:
 - a. The first atom listed, or the atom other than Hydrogen that appears only once in the chemical formula, is usually the central atom in a molecule or polyatomic ion with only two types of atoms (e.g., N is central in NH_4^+ , O is central in H_2O).
 - b. Carbon is the central atom in a carbon-containing compound (e.g., C is central in CO_2).
 - c. Some atom other than Hydrogen (H) and Oxygen (O) is usually central in a molecule or polyatomic ion with H, O, and a third kind of atom (e.g., S is central in HSO_4^-).

(continued →)

5. Arrange the atoms of the molecule or polyatomic ions around the central atom using the correct number of covalent bonds (*b*) to join these atoms.



6. Complete the Lewis dot structure by assigning nonbonding pairs of electrons to atoms so as to satisfy the octet rule (or duet rule for Hydrogen).



7. Double-check your work by making certain that the total number of electrons in your Lewis dot structure is equal to v .

Practice problems (Source: Kroschwitz, Winokur and Lees, 1995)

1. Write Lewis dot structures for the following molecules:



2. Write Lewis dot structures for the following polyatomic ions:

