Table 6.1 Steps to Determine Lewis Electron-Dot Structure of Covalent Compounds and Polyatomic Ions That Are Too Complicated to Determine by Normal Slot-Filling

1. **Count the electrons.** Count the number of outermost electrons on each of the atoms in the formula before bonding, and add to obtain the total number. This is the number of dots that must be shown in the Lewis electron-dot structure. If the formula is that of a polyatomic ion, also add to this number the extra electrons that are represented by the charge on the ion.

2. **Arrange the atoms.** Designate one of the atoms as the central atom and place the other atoms around it in some logical fashion. If there is more than one possibility for the central atom, choose the one that has the lowest electron affinity according to periodic trends. In addition, the following points should be considered:

   a. Hydrogen cannot be a central atom. This is logical because hydrogen becomes stable by sharing just two electrons, which means it only forms one bond with another atom. One bond means just one other atom can be attached to hydrogen. Central atoms may have from one to six atoms attached, as we shall see later. In oxyacids, each hydrogen is bonded to an oxygen.

   b. Oxygen never bonds to another oxygen except in oxygen gas (O_2), ozone gas (O_3), and peroxide (O_2^{2-}). Except for these, oxygen will never be the central atom. Normally, an oxygen atom bonds only twice, either with two single bonds or with one double bond.

3. **Distribute the electrons.** Without regard (yet) to the count in step 1, place eight electrons (dots) around all atoms, one pair on each side of the invisible square (making only single bonds for now), except for any hydrogens, which get just two dots.

4. **Count the electrons** that were distributed in step 3 and compare this count with the count that was obtained in step 1. These counts must match. If the counts match at this point, the electron dot structure you have drawn is the correct one. If it is a polyatomic ion, place parentheses around it and write the charge to the upper right.

5. **If the counts in steps 1 and 4 do not match,** make double or triple bonds between the central atom and other logical atoms. If the count in step 4 is greater than the count in step 1, the count in step 4 must be reduced. This can be done by introducing double or triple bonding (or both). Each double bond reduces the count in step 4 by two. Each triple bond reduces the count in step 4 by four. Of course, hydrogen cannot participate in a double or triple bond.

6. **If the central atom is a phosphorus atom,** or an atom of an element to the right or below phosphorus in the periodic table, the central atom may accommodate more than eight electrons, if necessary, to make the counts in steps 1 and 4 match.