

**SAMPLE PROBLEM D**

For more help, go to the *Math Tutor* at the end of this chapter.

Draw the Lewis structure for methanal,  $\text{CH}_2\text{O}$ , which is also known as formaldehyde.

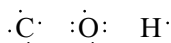
**SOLUTION**

1. Determine the number of atoms of each element present in the molecule.

The formula shows one carbon atom, two hydrogen atoms, and one oxygen atom.

2. Write the electron-dot notation for each type of atom.

Carbon is from Group 14 and has four valence electrons. Oxygen, which is in Group 16, has six valence electrons. Hydrogen has only one electron.



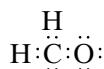
3. Determine the total number of valence electrons available in the atoms to be combined.

$$\begin{array}{rcl} \text{C} & 1 \times 4e^- & = 4e^- \\ \text{O} & 1 \times 6e^- & = 6e^- \\ 2\text{H} & 2 \times 1e^- & = 2e^- \\ & \hline & 12e^- \end{array}$$

4. Arrange the atoms to form a skeleton structure for the molecule, and connect the atoms by electron-pair bonds.



5. Add unshared pairs of electrons to each nonmetal atom (except hydrogen) such that each is surrounded by eight electrons.

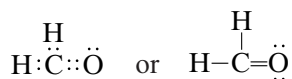


- 6a. Count the electrons in the Lewis structure to be sure that the number of valence electrons used equals the number available.

The structure above has six electrons in covalent bonds and eight electrons in four lone pairs, for a total of 14 electrons. The structure has two valence electrons too many.

- 6b. If too many electrons have been used, subtract one or more lone pairs until the total number of valence electrons is correct. Then move one or more lone electron pairs to existing bonds between non-hydrogen atoms until the outer shells of all atoms are completely filled.

Subtract the lone pair of electrons from the carbon atom. Then move one lone pair of electrons from the oxygen to the bond between carbon and oxygen to form a double bond.



There are eight electrons in covalent bonds and four electrons in lone pairs, for a total of 12 valence electrons.

**PRACTICE**

Answers in Appendix E

- Draw the Lewis structure for carbon dioxide,  $\text{CO}_2$ .
- Draw the Lewis structure for hydrogen cyanide, which contains one hydrogen atom, one carbon atom, and one nitrogen atom.

**extension**

Go to **go.hrw.com** for more practice problems that ask you to draw Lewis structures.



Keyword: HC6BNDX