Background Information:
In chemical bonds, atoms can either transfer or share their valence electrons. When electrons are shared, the bond is called a covalent bond. When electrons are transferred, the bond is called an ionic bond.

A covalent bond occurs when one or more pairs of valence electrons are shared by two non-metallic atoms. The atoms that participate in covalent bonding share electrons in a way that enables them to acquire a stable electronic configuration, or full valence shell. This means that they acquire the electronic configuration of the noble gas of their row. Obviously, the name of this rule is a misnomer. Helium, the noble (inert) gas of the first row, has only two electrons. Hydrogen, the only element in the first row besides Helium, fulfills the octet rule by sharing two electrons only.

In covalent bonds, the sharing of the electron pair may be equal or unequal. If sharing is unequal, electrons spend more time around the more nonmetallic atom. These are called polar covalent bonds. In such a bond, there is a charge separation with one atom being slightly positive and the other slightly negative.

Thus, the covalent bond in an oxygen molecule, O₂ (oxygen gas) is non-polar - electrons are shared equally. The covalent bond in HCl (hydrogen chloride gas) is polar, with the H being slightly positive and the Cl slightly negative.

An ionic bond occurs when one or more electrons from one metallic atom are transferred to another non-metallic atom, resulting in positive and negative ions; these are termed cations and anions respectively, which attract each other. When this happens, each individual ion achieves a noble (inert) gas electron configuration. NOTE: All ionic compounds are termed salts, not just table salt, NaCl.

Procedure for a Covalent Compound:
1. Draw the Lewis dot structure for each atom of the molecule to show how many valence electrons are present in each atom of the molecule. For example, the carbon atom in CO₂ in carbon dioxide has four valence electrons, and the oxygen atoms have six valence electrons.

2. Determine the placement of the atoms in your atom using electronegativity values. The ability of an atom to attract electrons in the presence of another atom is a measurable property called electronegativity (EN). If there is more than one atom type in the molecule, place the least electronegative atom in the center of your diagram. Electronegativity decreases from right to left and top to bottom of the periodic chart. Electronegativity values are shown on the periodic table available at [http://www.sciencegeek.net/tables/Electronegativity.pdf](http://www.sciencegeek.net/tables/Electronegativity.pdf).
Based on electronegativity (O EN = 3.5, C EN = 2.5; 2.5 < 3.5), the arrangement of atoms for CO$_2$ is:

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O  C  O
```

3. Arrange the electrons so that each atom has eight electrons in the shared valence shell.

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O: : C: : O:
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4. Count the electrons shared around each atom; are the octets complete? If so, your Lewis dot structure is complete.

5. If the octets are incomplete and more electrons remain to be shared, move one electron per bond per atom to make another bond.

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O: : C: : O: \rightarrow O: : C: : O: \text{ arrows show how electrons are shifted to make complete octets}
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6. Repeat steps 4 and 5 as needed until all octets are full.

7. Redraw the dots so that electrons, on any given atom, are in pairs wherever possible. When the pair is ‘shared’ between the atoms, draw a line indicating a bond. One bond between adjacent atoms is termed a ‘single’ bond. Two bonds between adjacent atoms are termed ‘double’ bonds. Three bonds between adjacent atoms are termed ‘triple’ bonds.

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\text{single bond: } O: : C: : O: \rightarrow O: : C: : O: \rightarrow O=C=O:
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8. Practice by drawing Lewis dot structures for the following molecules in your science notebook: H$_2$O, BeH$_2$, BF$_3$, SO$_2$, CH$_4$, CCl$_4$, NH$_3$. 

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**Procedure for an Ionic Compound:**

1. Draw the Lewis dot structure for each atom of the compound to show how many valence electrons are present in each atom. For example, the calcium atom in calcium chloride, CaCl$_2$, has two valence electrons, and the chlorine atoms have seven valence electrons each.

   ![Lewis dot structure for CaCl$_2$](image)

2. When calcium transfers its two valence electrons to the chlorine atoms, it becomes an ion (cation, specifically) with a 2+ charge, and each chlorine atom becomes an ion (anions, specifically) with a 1- charge on each. The Lewis structure shows the calcium with no dots (electrons), and the chlorine ions with a complete octet. Notice the placement of the charge notation on the ions.

   ![Lewis dot structure with charges](image)

3. The Ca and Cls are near each other, but the two dots (electrons) from each Cl should not be interpreted as a covalent bond. The final Lewis dot structure is as follows:

   

   ![Final Lewis dot structure](image)

4. Practice by drawing Lewis dot structures for the following ionic compounds in your science notebook: NaCl, MgCl$_2$, LiI, BeO.