# Chp 14 Lect 2: Chemical Bonding

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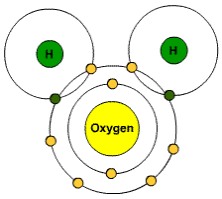
***Part 2: Covalent Bonds, Chemical Formulas, Structural Diagrams***




**Bond with me**

A chemical bond forms when atoms _____ or _____.
For example, in a water molecule, each hydrogen atom shares its single electron with the oxygen at the center. This way, all of the atoms are happy with full shells. Almost all elements form chemical bonds easily - which is why most matter is found in compounds.

**Types of bonds**

There are a couple different types of bonds. 1. _____ Bond, 2. _____ Bond, 3. _____ Bond. Today we are going to just talk about covalent bonds.

**Covalent Bonds**



A _____ is formed when atoms _____ electrons. The bonds between oxygen and hydrogen in a water molecule are covalent bonds. There are two covalent bonds in a water molecule, between the oxygen and each of the hydrogen atoms. Each bond represents one electron. In a covalent bond, electrons are _____ between atoms, not transferred.

**"M" is for Molecule**

A group of atoms held together by covalent bonds is called a _____. Water is a molecule, and so is sugar. Other examples of molecules are methane ($CH_4$), ammonia ($NH_3$), oxygen ($O_2$), nitrogen ($N_2$).

| Single bond | Double bond | Triple bond |
|---|---|---|
| H–H | O=O | N≡N |
| H:H | ·Ö::Ö· | ·N:::N· |

**Fancy Bonding**

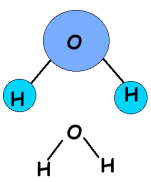
Sometimes, atoms share more than one electron. Occasionally, they can share 2 or even 3 electrons. These are called _____ and _____ bonds.

**Chemical Formulas**

Molecules are represented by a _____ _____. The chemical formula tells you the _____ of each kind of atom in the molecule. For example, the chemical formula for water is $H_2O$. The _____ 2 indicates there are two hydrogen atoms in the molecule. The chemical formula also tells you that water always contains twice as many hydrogen atoms as oxygen atoms.

Water is a simple molecule, so the formula is pretty easy. Let's look at a more complex molecule. Baking soda, or sodium bicarbonate, is $NaHCO_3$. That means it has: 1 Sodium (Na), 1 Hydrogen (H), 1 Carbon (C), 3 Oxygen (O)

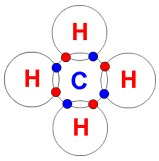
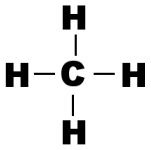
| You Try It! Chemical Formulas | |
|---|---|
| **Chemical Formula** | **Elements - #** |
| $C_6H_6$ | |
| $NH_3$ | |
| $Al(OH)_3$ | |
| $CO(NH_2)_2$ | |




**Structural Diagrams**

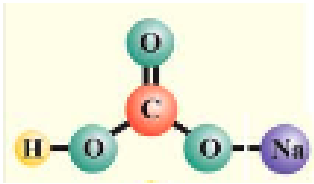
The shape of a molecule is also important to its function and properties. For this reason, molecules are represented by _____ which show the shape and arrangement of atoms. A single bond is represented by a bold short line.

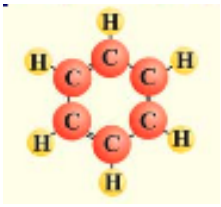
Double and triple bonds are indicated by _____ and _____ lines. Of course, real molecules are _____ not flat as shown in a structural diagram. For example, methane - $CH_4$ - has the shape of a 4-sided pyramid called a tetrahedron.

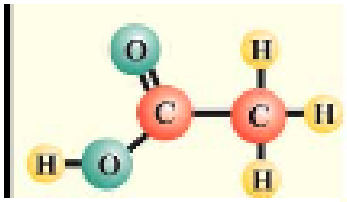
| Chemical Formula | Diagram with Electrons | Flat Structural Diagram | 3D Structural Diagram |
|---|---|---|---|
| $CH_4$ |  |  |  |

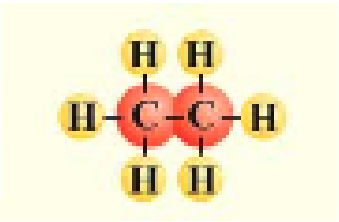
You Try It! Match the structural diagram with its chemical formula.

1. $C_2H_6$ _____ 2. $NaHCO_3$ _____ 3. $HC_2H_3O_2$ _____ 4. $C_6H_6$ _____









**Lewis Dot Molecules**

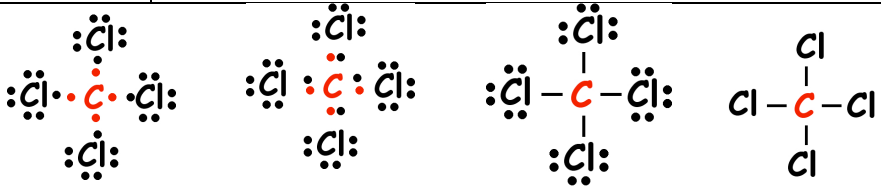
We've already seen how you draw a Lewis dot structure. The dots represent the valence electrons of an atom. We can draw Lewis dot structures for molecules too. Each element forms bonds to reach one of the magic numbers of valence electrons: _____ or _____. In dot diagrams of a happy molecule, each element symbol has either 2 or 8 dots around it.

**Lewis Dot Molecule – Example**

*Draw the dot diagram for carbon tetrachloride, $CCl_4$.*

1. List the elements in the molecule
2. Determine how many valence electrons each element has.
3. Match the elements so that each atom has 8 (or 2 for H & He) electrons.

Notice that with this molecule, each atom has 8 electrons. The shells are all full!!! Each chlorine atom shares an electron with carbon. In return, carbon shares its electrons with chlorine.



You can see how the drawing changes & becomes simpler & simpler.

You Try it! Lewis Dot