Chapter 2 **The Chemistry of Life** **Name _____**

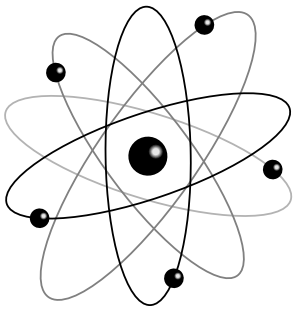
Worksheet Counting Atoms

The **formula** for a compound indicates the **elements** that make up the compound and the **number of atoms** of each element present in the compound. These numbers of atoms are indicated by the use of small numbers called subscripts. Sometimes groups of atoms act as a single atom. Such a group of atoms is called a **radical**. If a radical is used in a formula more than once, the radical is put in parentheses and the subscript appears outside the parentheses. When a subscript appears outside the parentheses, it indicates that all the elements inside the parentheses should be multiplied by that subscript. For example, the formula $Fe(OH)_3$ indicates the combination of one atom of iron, Fe, three atoms of oxygen, O, and three atoms of hydrogen, H.

In the following examples, list each element in the compound and the number of atoms of each element present. The first example has been done for you. You may already be familiar with some of the compounds.

Name	Use	Formula	Atoms in Formula
Calcium carbonate	Limestone	$CaCO_3$	Ca = calcium 1 C = carbon 1 O = oxygen 3
Aspirin	Pain reliever	$C_9H_8O_4$	
Magnesium hydroxide	Found in milk of magnesia	$Mg(OH)_2$	.
Paradichlorobenzene	Moth crystals	$C_6H_4Cl_2$	
Acetic acid	Found in vinegar	$C_2H_4O_2$	
Trinitrotoluene (TNT)	Explosive	$C_7H_5(NO_2)_3$	
Calcium dihydrogen phosphate	Fertilizer	$Ca(H_2PO_4)_2$	
Pyrite	Fool's gold	FeS_2	
Sucrose	Sugar	$C_{12}H_{22}O_{11}$	
Heptane	One of several components in gasoline	C_5H_{12}	

Sulfuric acid	Used in car batteries	H_2SO_4	
Cellulose	Found in wood products such as your pencil and paper	$C_6H_7O_2(OH)_3$	
Asbestos	Insulator	$H_4Mg_3Si_2O_9$	
Dichlorodiphenyl-trichloroethane (DDT)	Banned pesticide	$C_{14}H_9Cl_5$	
Silicon dioxide	Sand	SiO_2	
Iron oxide	Rust	Fe_2O_3	
Butane	Lighter fluid	C_4H_{10}	



Bonding and Chemical Formulas

When the chemical formula for a compound is written correctly, it shows the number of each type of atom in the compound. These numbers, called **subscripts**, are determined by the bonding between the atoms.

The table shows two columns of elements. The elements in the first column usually **give up electrons** when they form compounds. The elements in the second column usually **gain electrons** when they form compounds. The column next to the elements gives the number of electrons found in the outer level of each element. Using this information, determine the charge on the ion after the exchange of electrons. Remember, atoms that give up electrons become positive ions because they lose some of their negative charge. Conversely, atoms that gain electrons become negative ions because they accept more negative charge.

For example, sodium, Na, has one electron in its outer level. It gives up this electron and becomes a +1 ion. Sulfur, S, has 6 electrons in its outer level and gains 2 electrons to fill its outer shell with 8 electrons. Thus, sulfur becomes a -2 ion. These two ions combine to form Na_2S. This formula is correct because it takes 2 sodium ions to match the -2 charge on one sulfur ion. Now show how the positive ion would combine with the negative ion in the same row to form a neutral compound.

Element	Electrons in Outer Orbit	Charge on Ion	Element	Electrons in Outer Orbit	Charge on Ion	Formula
Aluminum	3		Chlorine	7		
Magnesium	2		Bromine	7		
Sodium	1		Oxygen	6		
Lithium	1		Oxygen	6		
Calcium	2		Phosphorus	5		
Carbon	4		Chlorine	7		
Aluminum	3		Oxygen	6		
Beryllium	2		Sulfur	6		
Sodium	1		Fluorine	7		
Silicon	4		Neon	8		

Analysis and Conclusion:

1. Explain why water's chemical formula is H_2O.

2. Hydrogen peroxide's formula is H_2O_2. Draw a structural formula for both water and hydrogen peroxide on the back of this paper.