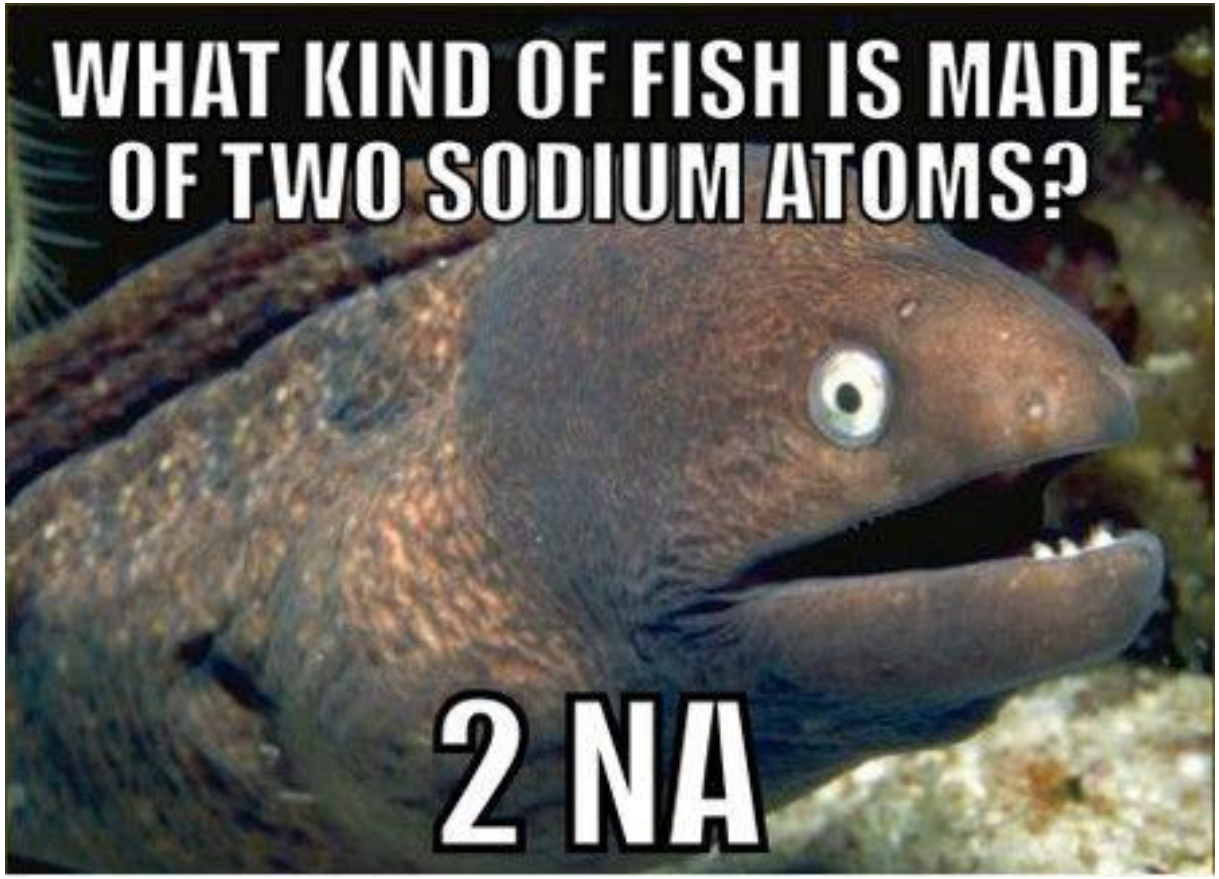
Counting Atoms

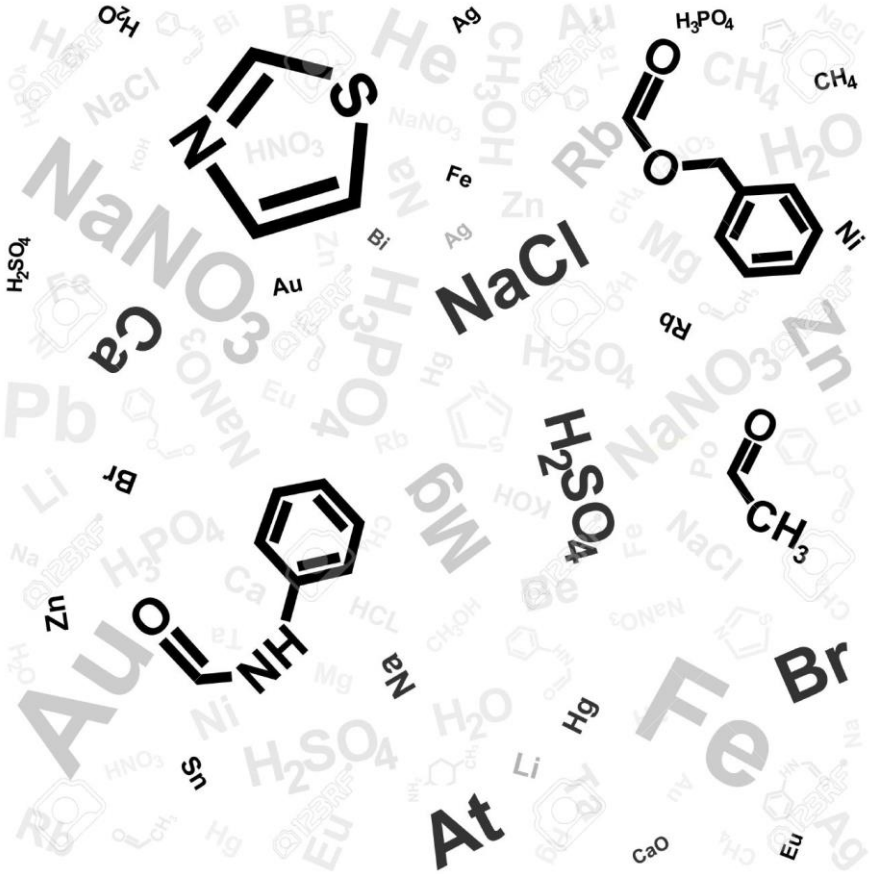


S1-2-10 Interpret chemical formulas of elements and compounds in terms of the number of atoms of each element. Examples: He, H_2, O_2, H_2O, CO_2, NH_3

Chemical Formulas

The combination of **CHEMICAL SYMBOLS** that show:

- What **ELEMENTS** make up a **CHEMICAL COMPOUND.**
- How many **ATOMS** of **EACH ELEMENT** there are.



Chemical Formulas

For example, the chemical formula for water is

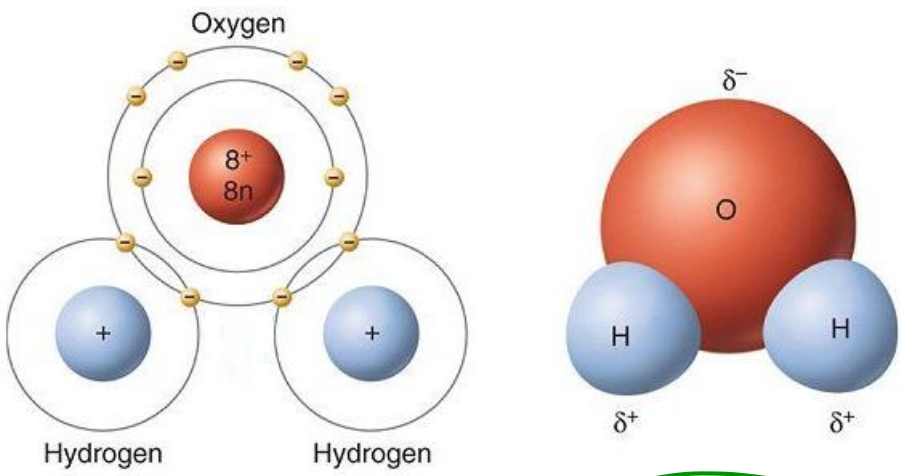
$$H_2O$$

- The letter **H** stands for **HYDROGEN**.
- The letter **O** stands for **OXYGEN**.
- The **2** tells you that there are **2 ATOMS** of **HYDROGEN**.
- There is a **1** **UNDERSTOOD** after the **O**.

This means that there are **2 ATOMS** of **HYDROGEN** and **1 ATOM** of **OXYGEN** present in a water molecule. The number 2 is called a **SUBSCRIPT.**

Chemical Formulas

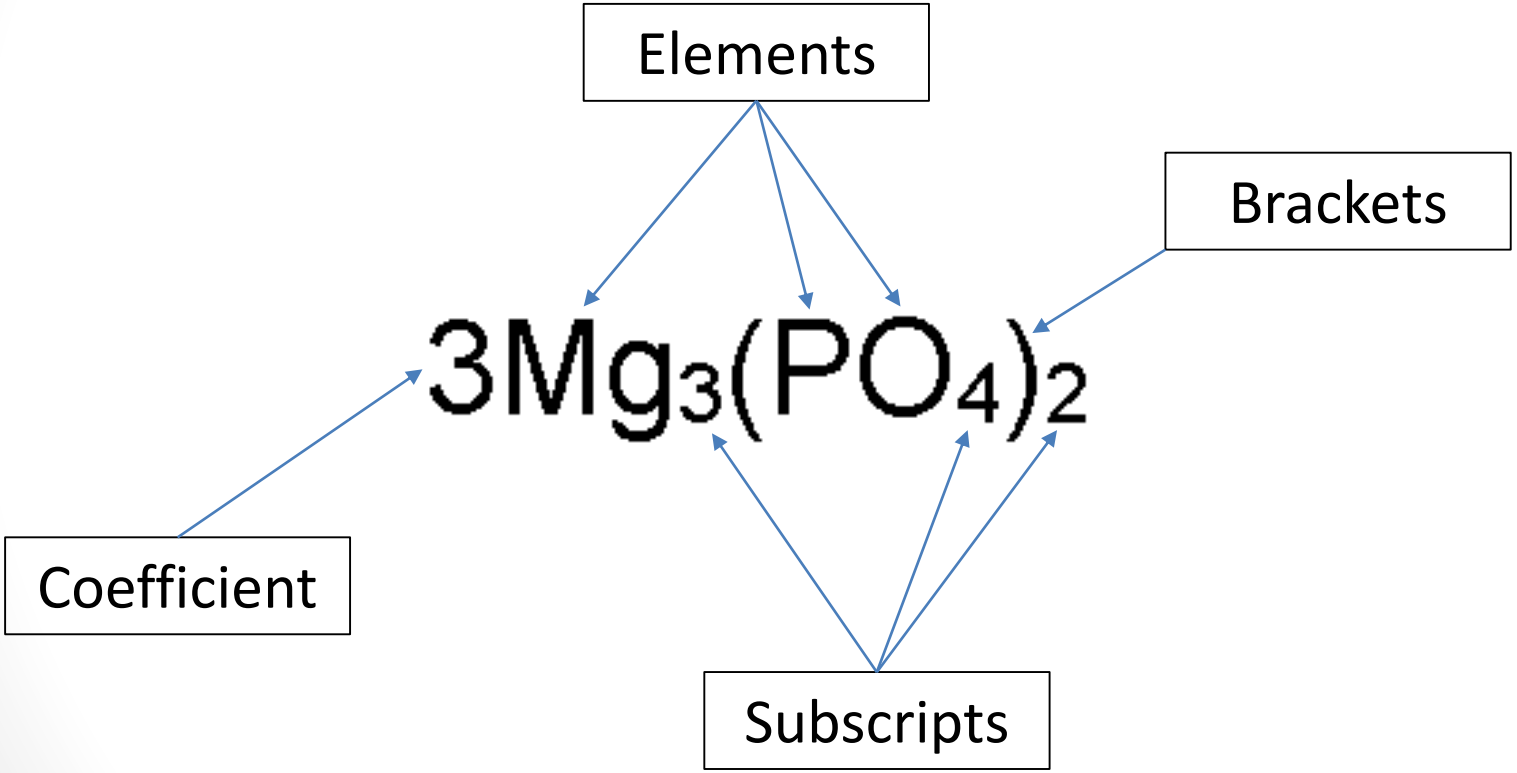
This is what water looks like:



Is water a compound, element or a molecule?

Chemical Formulas

Some chemical formulas can be quite complex, and have many different parts:



Counting Atoms…

It is important to be able to interpret and understand chemical formulas….this means being able to count the atoms of each element in a compound

Rules for Counting Atoms…

1. **Symbols:**
   - Each **CAPITAL** letter means that there is a **NEW ELEMENT**

Ex) Li_2Cl_3 → is made of **LITHIUM** and **CHLORINE**

Na_2SO_4 → is made of **SODIUM**, **SULPHUR** and **OXYGEN**

Counting Atoms…

2. **Subscripts:**
   - A **NUMBER** that comes after a **SYMBOL** and **BELOW**.
   - The subscript only affects the element it **COMES AFTER**.

Ex) Li_2Cl_3

→ Has **2 LITHIUM ATOMS** and **3 CHLORINE ATOMS**

Na_2SO_4

→ Has **2 SODIUM ATOMS**, **1 SULPHUR ATOM** and **4 OXYGEN ATOMS**

Counting Atoms…

3. **Brackets:**
   - A **SUBSCRIPT** **OUTSIDE** a bracket affects **ALL** the elements **INSIDE** the bracket…(ie. **MULTIPLY**!!!)

Ex) ***$Al(SO_4)_3$***

→ Has **1 ALUMINUM** atom, **3 SULPHUR** atoms and **12 OXYGEN** atoms

→***there's 3 of everything in the brackets!***

Counting Atoms…

4. **Coefficients:**
   - A "**FULL SIZE**" number in **FRONT** of a chemical **FORMULA**.
   - **MULTIPLIES** everything in the formula:

Ex) ***$2Na_2SO_4$***

→ Has **4 SODIUM** atom, 2 **SULPHUR** atoms and ~~4~~ 8 **OXYGEN** atoms

$2Al(SO_4)_3$

→ Has **2 ALUMINUM** atom, **6 SULPHUR** atoms and **24 OXYGEN** atoms

Counting Atoms Examples…

Find the elements present, and the number of atoms of each element for:

1. Glucose – $C_6H_{12}O_6$

Elements Present	Number of Atoms
Carbon	6
Hydrogen	12
Oxygen	6
Total Number of Atoms:	24

Counting Atoms Examples…

2. Antacid – $CaCO_3$

Elements Present	Number of Atoms
Calcium	1
Carbon	1
Oxygen	3
Total Number of Atoms:	5

Counting Atoms Examples…

3. Lead Nitrate – $2Pb(NO_3)_2$

Elements Present	Number of Atoms
lead	2
nitrogen	4
Oxygen	12
Total Number of Atoms:	18

Try these ones…

Count the number of atoms of each element in the following compounds:

$CuSO_4$

Elements Present	Number of Atoms
copper	1
sulphur	1
oxygen	4
Total Number of Atoms:	6

Li_2CO_3

Elements Present	Number of Atoms
lithium	2
carbon	1
oxygen	3
Total Number of Atoms:	6

Try these ones…

Count the number of atoms of each element in the following compounds:

$Al_2(SO_4)_3$

Elements Present	Number of Atoms
aluminum	2
sulphur	3
oxygen	12
Total Number of Atoms:	17

$4Na_2CO_3$

Elements Present	Number of Atoms
sodium	8
carbon	4
oxygen	12
Total Number of Atoms:	24