B4 Apply simplified chemical nomenclature in describing elements, compounds and chemical reactions

B4.1 read and interpret chemical formulas for compounds of two elements, and give the IUPAC (International Union of Pure and Applied Chemistry) name and common name of these compounds (e.g., give, verbally and in writing, the name for $NaCl_{(s)}$ (sodium chloride), $CO_{2(g)}$ (carbon dioxide), $MgO_{(s)}$ (magnesium oxide), $NH_{3(g)}$ (nitrogen trihydride or ammonia), $CH_{4(g)}$ (carbon tetrahydride or methane), $FeCl_{2(s)}$ (iron(II) chloride), $FeCl_{3(s)}$ (iron(III) chloride)

Chemical Formulas

For ease of communication, the International Union of Pure and Applied Chemistry, IUPAC, has developed a system for naming chemical compounds. The IUPAC rules state that for the names of ionic compounds, the metal is named first. The non-metal is written second, and its name is changed so that it ends in the suffix –ide.

For example, AlN is named aluminum nitride, and $MgCl_2$ is named magnesium chloride.

Sometimes, a metal can have more than one possible ion charge. For example, copper can have a charge of 2+ or 1+. When naming an ionic compound, it needs to be clear which ion is being used. For that reason, a roman numeral is added to the chemical name. For example, copper(II) chloride is a compound that contains a Cu^{2+} ion, and copper(I) chloride is a compound that contains a Cu^{1+} ion.

Unlike ionic compounds, molecular compounds use prefixes to show how many atoms of each element are present.

Number of Atoms	Prefix
1	Mono–
2	Di–
3	Tri–
4	Tetra–
5	Penta–

Molecular compounds are named using the following rule:

Prefix + first element prefix + second element (ending in –ide)

Note: If the first element only has one atom, the prefix mono– is not used.

Example

N_2O_3 → *dinitrogen trioxide*

CCl_4 → *carbon tetrachloride*

Some compounds also have common names. For example, the chemical formula H_2O would be named according to IUPAC rules as dihydrogen monoxide. This compound is more commonly referred to by its common name, water.

B4.2 identify/describe chemicals commonly found in the home, and write the chemical symbols (e.g., table salt [$NaCl_{(s)}$], water [$H_2O_{(l)}$], sodium hydroxide [$NaOH_{(aq)}$] used in household cleaning supplies)

Common Household Chemicals

There are ionic and molecular compounds all around you. Even in your home, there are many compounds you use frequently. The following table outlines some common chemical compounds, their formulas, common names, and compound type.

Name	Formula	Ionic or Molecular
Baking soda	$NaHCO_{3(s)}$	Ionic
Salt	$NaCl_{(s)}$	Ionic
Water	$H_2O_{(l)}$	Molecular
Table sugar	$C_{12}H_{22}O_{11(s)}$	Molecular
Rubbing alcohol	$C_3H_8O_{(l)}$	Molecular
Hydrogen peroxide	$H_2O_{2(l)}$	Molecular

B4.3 identify examples of combining ratios/number of atoms per molecule found in some common materials, and use information on ion charges to predict combining ratios in ionic compounds of two elements (e.g., identify the number of atoms per molecule signified by the chemical formulas for $CO_{(g)}$ and $CO_{2(g)}$; predict combining ratios of iron and oxygen based on information on ion charges of iron and oxygen)

Predict Combining Ratios for Ionic Compounds

If you know the chemical name and the ion charges of a compound, you can write its chemical formula. First, write the metal element's symbol with the ion charge. Next to it, write the non-metal element's symbol and charge. Remember that ion charges are found in the periodic table and are written as **superscripts**. The net charge of the compound must be zero, so the positive charges must be balanced with the negative charges.

In the following example, you will see that there must be two chlorine ions, each with a charge of 1– to balance out the 2+ charge of the magnesium ion. Finally, write the formula, using **subscripts** to indicate how many atoms of each element are present. Do not include the ion charges in this step. Note that if only one atom is present, no subscripts are used.

Example
Magnesium Chloride

- Mg^{2+} Cl^{1-}
- Mg^{2+} Cl^{1-} Cl^{1-}
- $MgCl_{2(s)}$

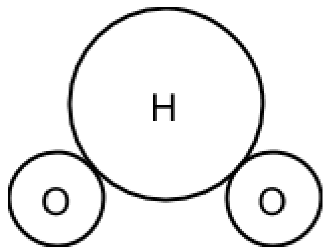
B4.4 assemble or draw simple models of molecular and ionic compounds (e.g., construct models of some carbon compounds using toothpicks, peas and cubes of potato) [Note: Diagrams and models should show the relative positions of atoms. Diagrams of orbital structures are not required at this grade level.]

Drawing Molecular and Ionic Compounds

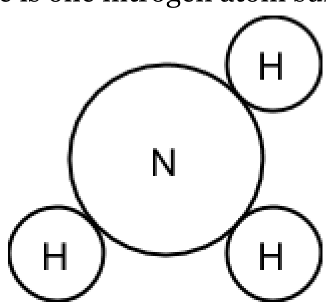
Many of the common substances you use every day are made up of simple compounds. To get a better understanding of these compounds, scientists build models of them. These models are useful because they represent what a molecule would look like if you were able to see it. The model can reveal useful information about a molecule by showing how many atoms of each element are present and how they are arranged.

For example, the chemical formula for water is H_2O. The letters represent elements found on the periodic table. The subscript number after the letter indicates how many atoms of that particular element are present in the compound. If no number is found after an element, it means there is only one atom of that element present. For water, the first letter, H, represents hydrogen. The subscript, 2, that comes after H indicates there are two hydrogen atoms present. The O represents oxygen. No number is found after the O, which indicates that only one atom of oxygen is present.

To draw a molecule of water, simply place the oxygen in the centre, and attach the two hydrogen molecules to it.



Ammonia has the chemical formula NH_3. There is one nitrogen atom surrounded by three hydrogen atoms.



Carbon dioxide, CO_2, can be drawn in the following manner: