

The rules dictate how a chemical formula is written (and how to write the name), such as “H is written before O and “C is written before H” and are very simple (but do take some practice to get comfortable using). The overall idea is that, generally, the most metallic element is listed first in the chemical formula:

- If there is a metal in the compound (Group 1/1A or 2/2A element), then it is written first.
- If the compound contains only elements from this “list of 10,” then they are named in the following order:
  - 1st—carbon (C)
  - 2nd—phosphorous (P)
  - 3rd—nitrogen (N)
  - 4th—hydrogen (H)
  - 5th—sulfur (S)
  - 6th—iodine (I)
  - 7th—bromine (Br)
  - 8th—chlorine (Cl)
  - 9th—oxygen (O)
  - 10th—fluorine (F)
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- If the compound contains one non-metal and one element from the list of 10, then follow the Periodic table rules to determine which of the elements is more metallic (see Figure 8.4.1 for further details).

**Figure 8.4.1**

### Periodic Table of the Elements and Naming Compounds

As I hope you are learning, the periodicity of the Periodic Table is a great help in all aspects of chemistry, and when it comes to correctly writing chemical formulae, it is once again our friend. The overall structure for writing chemical formulae is that the most metallic element is written first, followed, generally, by the next most metallic element, and so on. Clearly, if the compound contains an element from Group 1/1A or 2/2A, then that element is listed first in the chemical formula since those are metals. Perhaps you are wondering, “How am I supposed to know which element is metallic and which isn’t?” The periodicity of the Periodic table comes to the rescue. Even if you don’t know anything about the elements in a compound, by following the naming rules and using the Periodic Table to direct you regarding the metallic nature of the elements, you can give it the correct chemical formula. For example, if you know a compound is composed of 2 atoms of oxygen (O) and 1 atom of silicon (Si) and are asked to write the chemical formula for it, you would consult the naming rules and find that this compound does not contain a metal. Also, you’d find that oxygen is on the list of 10 but silicon is not. So, you need to determine which one is more metallic, oxygen or silicon. There are many clues from the Table to get you on the right track:

- 1) O is classified as a “non-metal” (its box is white, which means it is a “non-metal” ...look at our official Table on the inside front cover for the color coding).
- 2) Si is to the left of oxygen in the Table, meaning that it is more “metally” than oxygen.
- 3) Si is one period lower than O, which means it is likely more metallic than oxygen (but remember you do need to be careful with this rule when the elements are not in the same group, and Si and O are not in the same group).

Therefore, it is very reasonable to determine that silicon is more metallic than oxygen and so it would be written first. The formula, therefore, is  $\text{SiO}_2$ , which is correct.

What about the chemical formula for the compound composed of 1 selenium (Se) atom and two bromine (Br) atoms? Se is a non-metal, atomic number 34 and Br is a halogen, atomic number 35. The first thing to realize is that just because Groups 17/7A and 18/8A are not listed as “non-metals,” doesn’t mean they are metals. They are non-metals! It is just that Group 17/7A elements already have a name—the halogens—as do Group 18/8A elements—the Noble gases. So, consulting the rules for **listing/naming** elements in a compound, we find that neither selenium nor bromine is a Group 1/1A or 2/2A element AND **only bromine is in** the list of 10; therefore, we need to determine which is more metallic, **by using our knowledge of the Periodic Table**. Selenium is to the left of bromine, **and they are in the same Period**, which means that we expect selenium is more metallic than bromine (or bromine is less metallic than selenium); therefore, selenium should be listed first in the chemical formula. Since we have 1 selenium atom and 2 bromine atoms and selenium is written first, the formula is “ $\text{SeBr}_2$ .”

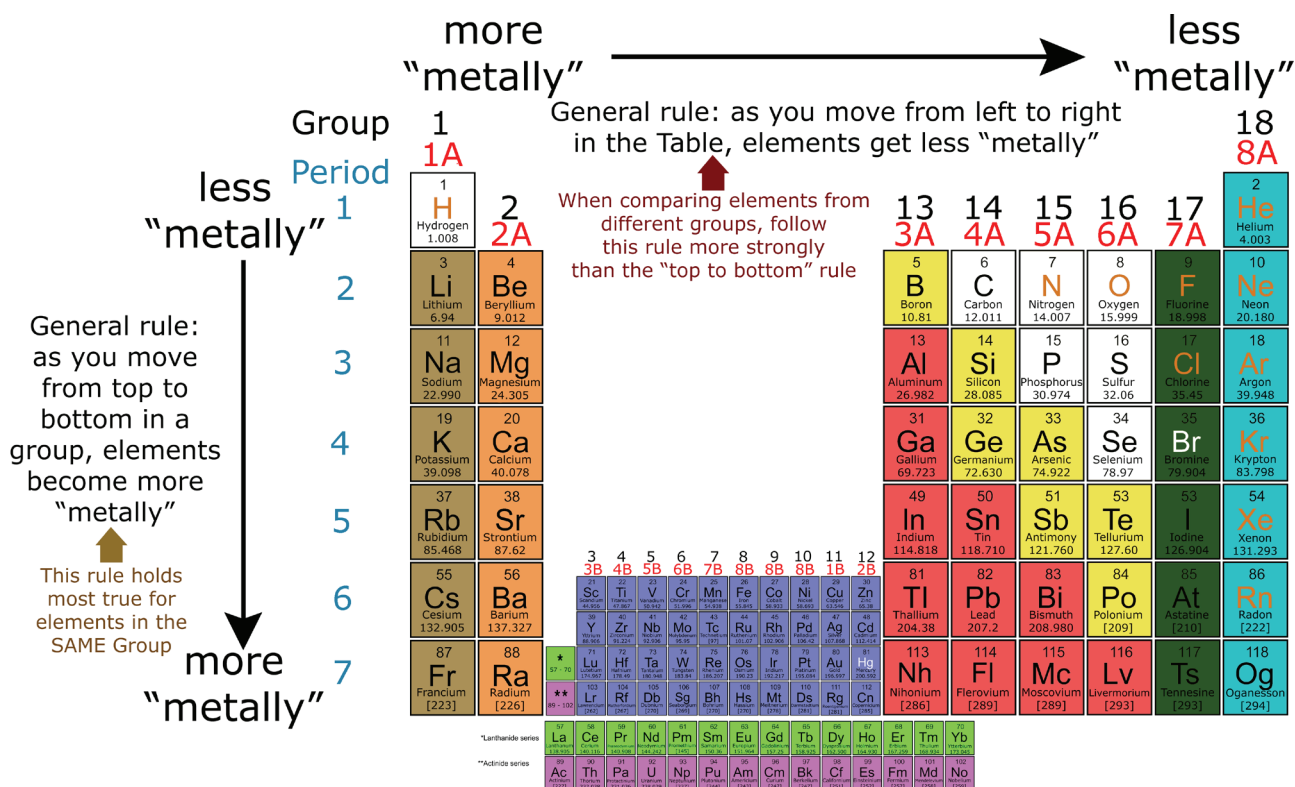
Note that there can be deviation from the “most metallic element is written first” rule as it pertains to the list of 10. Usually, the naming rules are followed, but not always and sometimes you just need to go with the flow so I just want you to be aware that the rules aren’t ALWAYS followed strictly. For example, while hydrogen (H) is a non-metal, it’s also in Group 1, all the way to the left of the Table. According to our rule of metallic nature, since it’s way over to the left in the Table, H should be the “most metallic” of those 10 elements in the list of 10. So, if we were to follow the rule of writing the most metallic element first, it seems like hydrogen should be written before carbon, phosphorus and nitrogen. But it isn’t. The reason is mainly historical, meaning that they are sometimes listed “out of order” because that’s how chemists have always done it. Not a great reason, I know, but that is how it is done.

Before we move on from this subject let’s do a couple more examples.

- Write the chemical formula for the molecular compound containing 1 selenium atom for every 2 oxygen atoms.
  - To figure this out, look at the Periodic Table and see that neither Se nor O are in Group 1/1A or 2/2A AND both are color-coded as “non-metals.”
  - Selenium is not in the list of 10 but oxygen is; therefore, we need to determine, based upon our knowledge of the Periodic Table, which is more metallic, Se or O.
    - Selenium and oxygen are both in the same group and selenium is further down in the column; therefore, it is more metallic and is written first in the chemical formula.

**SeO<sub>2</sub> is correct.**

Figure 8.4.1 (continued)



2. Write the proper chemical formula for the molecular compound formed from 1 atom of sulfur for every 2 atoms of hydrogen.
- You first look at the Periodic Table and find that sulfur and hydrogen are both color-coded as “non-metals.” Remember, although hydrogen is in Group 1/1A, it is NOT a metal. Since they are both non-metals, we need to consult the list of 10.
  - Hydrogen and sulfur are both on it; therefore, we follow the rule as directed by that list.
    - Hydrogen is listed before sulfur in a chemical formula.

**H<sub>2</sub>S is correct.**

3. Write the proper chemical formula for the ionic compound containing 1 atom of tellurium for every 2 atoms of potassium.
- Tellurium (Te) is in Group 16/6A and potassium is in Group 1/1A (and it is color coded as a metal). So, right there, we can stop because potassium is written first since it is a metal.
  - However, let’s say we don’t realize that and we’ll work through this problem for the sake of showing the value of the periodicity of the Table.
    - K, atomic number 19, is in Group 1/1A, Period 4 and Te, atomic number 52, is in Group 16/6A and Period 5. K is much further to the left than Te, so according to the “elements to the left are more metallic than those to the right,” it seems like K is more metallic.
  - But, we also recognize that Te is further down in the Table than K. Since we know that elements that are “further down” than others are more metallic, this seems to be a little confusing, but there are two clues that help us to come to the right determination—the color coding and the notes in the graphic itself of **Figure 8.4.1**.
    - Color coding—using this, we see that K is a “metal” and Te is a “metalloid.” “Metalloid” means “metal-like” and “metal” means, well, “metal.” What is more metallic, an element that is “like a metal” or an element that is a metal? Clearly, the metal is more metallic than something that is “like” a metal. One indication that K is more metallic than Te.
    - The two notes in **Figure 8.4.1** clarify for us that we should follow the “left of the Table is more metallic than right” rule over the “bottom is more metallic than top” rule when comparing elements that are not in the same Group. This also confirms that K is more metallic than tellurium since they are not in the same Group AND K is further to the left.

**K<sub>2</sub>Te is correct.**

4. Write the appropriate chemical formula for the molecular compound formed when 1 atom of nitrogen bonds with 1 atom of oxygen.
- Reviewing our rules, we see that both N and O are in the list of 10. According to the list, N appears in the chemical formula before O.

**NO is correct.**