

LESSON 8 | What is a polyatomic ion?

Many friends are "extra" good friends. They get together very often. And then, they seem to act like one person.

Certain elements are like that. They "get together" whenever possible. And then, they act as if they were one element.

A group of atoms that behaves like a single atom is called a **polyatomic** [PAHL-i-uh-tahm-ik] ion. A polyatomic ion has its own oxidation number.

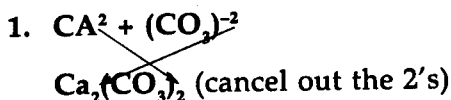
Eight common radicals along with their oxidation number are listed on the facing page. All the common radicals have a minus oxidation number except one. The ammonium radical (NH_4) has a +1 oxidation number (NH_4)⁺¹.

The radicals in the chart are listed within parenthesis like (OH). A parenthesis is not always needed. For example, the (OH) in the formula Na(OH) does not need a parenthesis. It can be written as NaOH.

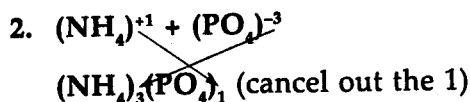
A parenthesis is always needed when a subscript follows a radical. Take this formula for example— $\text{Ca}(\text{OH})_2$. The small 2 after the OH is a **subscript**. It means that one molecule of this compound has two hydroxyl (OH) radicals.

How do you find the formula for a simple compound that has one or even two radicals? It's simple. Just criss-cross the oxidation numbers—just as you did last lesson.

Here are two examples.



The final formula is $\text{Ca}(\text{CO}_3)$ or CaCO_3 . Either one may be used. The name for this compound is calcium carbonate.



The final formula is $(\text{NH}_4)_3\text{PO}_4$. The name for this compound is ammonium phosphate.

UNDERSTANDING POLYATOMIC IONS

Radical	Formula and Oxidation Number
Ammonium	$(\text{NH}_4)^{+1}$
Bicarbonate	$(\text{HCO}_3)^{-1}$
Hydroxyl	$(\text{OH})^{-1}$
Nitrate	$(\text{NO}_3)^{-1}$

Radical	Formula and Oxidation Number
Carbonate	$(\text{CO}_3)^{-2}$
Sulfite	$(\text{SO}_3)^{-2}$
Sulfate	$(\text{SO}_4)^{-2}$
Phosphate	$(\text{PO}_4)^{-3}$

The chart above shows eight common polyatomic ions.

Now look at the chart below. The names of the eight radicals are listed in Column A.

Do the following:

- In Column B, write the formula of each polyatomic ion.
- In Column C, list the elements that make up each radical and the number of atoms of each element.
- In Column D, list the oxidation number of each polyatomic ion.

The first one has been completed for you.

	A	B	C	D
	Radical Name	Formula	Elements and Number of Atoms of Each	Oxidation Number
1.	Sulfate	SO_4	Sulfur—1 atom Oxygen—4 atoms	-2
2.	Bicarbonate			
3.	Nitrate			
4.	Ammonium			
5.	Phosphate			
6.	Carbonate			
7.	Hydroxyl			
8.	Sulfite			