

Ionic Compounds Containing *Polyatomic* Ions

As you've already learned, ionic compounds are formed by the combination of a **positive ion** (cation) and a **negative ion** (anion). This is the same when dealing simple ions or complex ions. Be careful to note, however, that complex ions are **grouped together** and should not be separated.

Nitrate, for example, has the formula NO_3^- . When writing a chemical formula, don't ever separate the nitrate ion into nitrogen and oxygen. **If it's written as a group, keep it as a group!**

Since complex ions come in groups, things can get tricky when using subscripts. As a result, we use **parentheses** to separate the ion from the subscript:

If we need two nitrates in a compound, we write: $(\text{NO}_3)_2$.

If we need three nitrates in a compound, we write: $(\text{NO}_3)_3$.

And, just as before, the **net charge** of the compound must be **zero**. For a salt containing sodium ion, Na^+ , and nitrate, NO_3^- , the ratio the ratio would be 1:1 since the positive and negative charges cancel out. Therefore, the formula is NaNO_3 and it is called **sodium nitrate**. (No parentheses are necessary here).

For a salt containing calcium ion, Ca^{2+} , and nitrate, NO_3^- , the ratio must be 1:2 (one calcium ion for every two nitrates). So, the formula would be **$\text{Ca}(\text{NO}_3)_2$** .

Ionic Compounds Containing *Transition Metals*

Some elements (known as transition metals) form **more than one** ion and therefore must be labeled accordingly. For example, iron forms two ions: **Fe^{2+}** and **Fe^{3+}** . We call these ions "iron (II) ion" and "iron (III) ion" respectively.

When naming any ion from the elements listed above, you **MUST** include a Roman numeral in parentheses following the name of the ion. This roman numeral is equal to the **charge** on the ion. We don't include the "+" because all metal ions are positive. Here are two more examples:

Cu^+ = "copper (I) ion"

Cu^{2+} = "copper (II) ion"

Similarly, when naming a **compound** containing one of these transition metals, you must include the Roman numeral as well. "Iron Chloride" isn't specific enough since the compound could contain either iron (II) or iron (III) ion. You must specify the charge on the iron.

- Iron (II) chloride contains the Fe^{2+} ion. When combined with chloride, Cl^- , we know the formula must be FeCl_2 .
- Iron (III) chloride contains the Fe^{3+} ion. This time, three chlorides are required to form a neutral compound. Therefore, the formula is FeCl_3 .

Name _____

Period _____

Ionic Compounds Worksheet #2

Please write correct formulas for the ionic compounds listed below.

1. **Potassium nitrate** – an ingredient in gunpowder (also known as “saltpeter”)
2. **Calcium sulfate** – a component of plaster and chalk
3. **Calcium phosphate** – a component of fertilizer as well as bones and teeth
4. **Iron (III) chloride** – used in water purification
5. **Aluminum sulfate** – also known as “alum,” used in water purification
6. **Sodium hydrogen carbonate** – baking soda (also known as sodium bicarbonate)
7. **Magnesium hydroxide** – relieves upset stomach and heartburn (milk of magnesia)
8. **Iron (III) oxide** – also known as rust
9. **Calcium carbonate** – the chemical name for marble and limestone
10. **Ammonium Hydroxide** – otherwise known as household ammonia.
11. **Calcium Hydroxide** – also known as “slaked lime,” is a component of cement.
12. **Copper (II) Sulfate** – a bright blue salt used as an algacide and a disinfectant.
13. **Ammonium Nitrate** – used in fertilizers and instant cold-packs
14. **Lead (II) Iodide** – a bright yellow compound formerly used in paints and dyes
15. **Sodium Nitrite** – a preservative found in processed meats