# LESSON 7
# POLYATOMIC IONS & COMPOUNDS

# Polyatomic Ions & Compounds

- **Polyatomic ion**: Groups of atoms that tend to stay together and carry on OVERALL **ionic charge**. The group of atoms do not separate when they combine with other ions.
- The prefix "poly" means "**more than one**".
- Each polyatomic ion has its own **name**, **formula**, and **charge**.
- **Hydroxide**, **carbonate**, and **bicarbonate** are **NOT on the periodic table** because they are not elements.

# Formulas & Charges of Polyatomic Ions

| Polyatomic Ion | Ion Formula | Ionic Charge |
|---|---|---|
| Nitrate ion | $NO_3^-$ | – 1 |
| Nitrite ion | $NO_2^-$ | – 1 |
| Hydroxide ion | $OH^-$ | – 1 |
| Hydrogen carbonate ion / Bicarbonate ion | $HCO_3^-$ | – 1 |
| Chlorate ion | $ClO_3^-$ | – 1 |
| Carbonate ion | $CO_3^{2-}$ | – 2 |
| Sulfate ion | $SO_4^{2-}$ | – 2 |
| Phosphate ion | $PO_4^{3-}$ | – 3 |
| Ammonium ion | $NH_4^+$ | +1 |

The **negative polyatomic ions** act like **non-metals** in ionic compounds

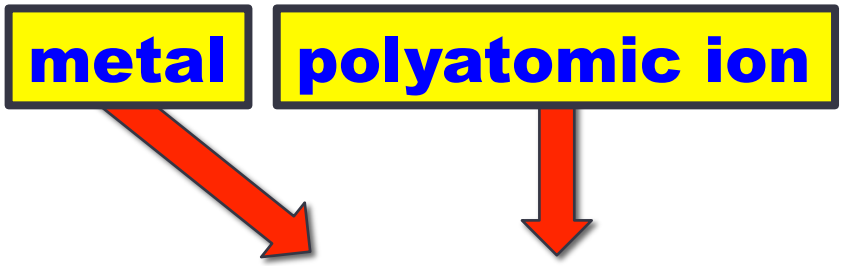
**Ammonium** acts like a **metal** in ionic compounds

# Naming Polyatomic Compounds

- A **polyatomic compound** has **2 parts**:
  - a **positive** (metal) ion
  - a **negative** (polyatomic) ion
- To **name a polyatomic compound**:
  - Name the **positive (metal) ion first**, using the name that appears on the periodic table.
  - Name the **negative (polyatomic) ion** second.
- **DO NOT CHANGE** the **ending** of a polyatomic ion.

# Naming Polyatomic Compounds

***Examples:***




sodium + sulfate ion → sodium sulfate

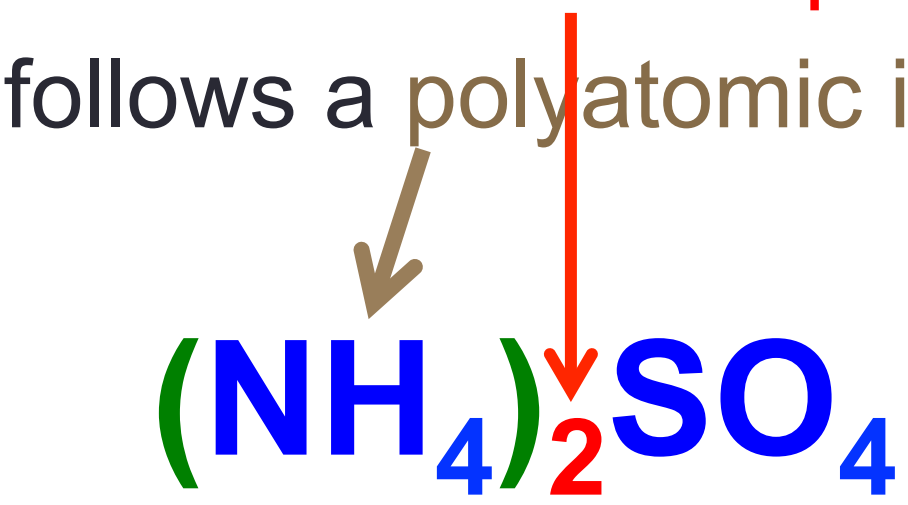
# Writing Chemical Formula

Parentheses ()

are **always needed**

when a subscript

follows a polyatomic ion.



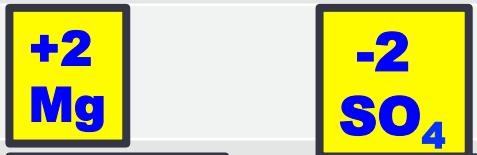
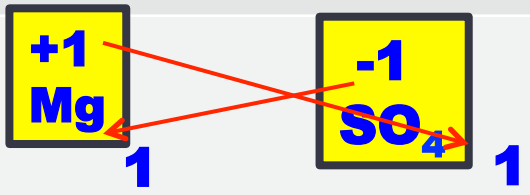
# Writing Chemical Formula

| Steps | sodium & nitrate |
|---|---|
| 1. Write down the symbols of **positive ion** first. | Na  $NO_3$ |
| 2. Write the **ionic charge** above the symbol. | +1 Na  -1 $NO_3$ |
| 3. If applicable, **divide** the ionic charge by the **highest common multiple**. (i.e. reduce ratio) | +1 Na  -1 $NO_3$<br>can't reduce |
| **4. Criss-cross** the ionic charge and **drop** the signs. | +1 Na  -1 $NO_3$<br>1  1 |
| 5. Drop all 1's and **add bracket** when necessary. | $NaNO_3$ |
| **NAME OF COMPOUND** | **sodium nitrate** |
| **Descriptions** | 1 **sodium** ion bonds with 1 **nitrate** ion |

# Writing Chemical Formula

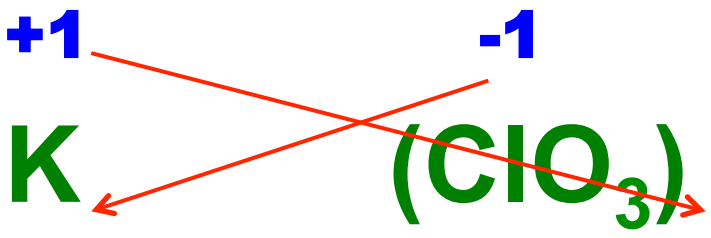
| Steps | ammonium & phosphate |
|---|---|
| 1. Write down the symbols of **positive ion** first. | $NH_4$ $PO_4$ |
| 2. Write the **ionic charge** above the symbol. | +1 $NH_4$ -3 $PO_4$ |
| 3. If applicable, **divide** the ionic charge by the **highest common multiple**. (i.e. reduce ratio) | +1 $NH_4$ -3 $PO_4$ can't reduce |
| **4. Criss-cross** the ionic charge and **drop** the signs. | +1 $NH_4$ -3 $PO_4$ 3 1 |
| 5. Drop all 1's and **add bracket** when necessary. | $(NH_4)_3PO_4$ Must add bracket |
| **NAME OF COMPOUND** | **ammonium phosphate** |
| **Descriptions** | 3 **ammonium** ions bond with 1 **phosphate** ion |

# Writing Chemical Formula

| Steps | magnesium & sulfate |
|---|---|
| 1. Write down the symbols of **positive ion** first. |   |
| 2. Write the **ionic charge** above the symbol. |   |
| 3. If applicable, **divide** the ionic charge by the **highest common multiple**. (i.e. reduce ratio) |   |
| **4. Criss-cross** the ionic charge and **drop** the signs. |   |
| 5. Drop all 1's and **add bracket** when necessary. | $MgSO_4$ |
| **NAME OF COMPOUND** | **magnesium sulfate** |
| **Descriptions** | 1 **magnesium** ion bonds with 1 **sulfate** ion |

## *Practice:*

What is the formula of **potassium chlorate**?




**$K(ClO_3)$**