Polyatomic Ions

- a polyatomic ion is an ion made of more than one atom
- acts as a single particle

Ex. Common Polyatomic Ions

<table>
<thead>
<tr>
<th>Polyatomic Ion</th>
<th>Ion Formula</th>
<th>Ionic Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>nitrate</td>
<td>$\text{NO}_3^-$</td>
<td>-1</td>
</tr>
<tr>
<td>nitrite</td>
<td>$\text{NO}_2^-$</td>
<td>-1</td>
</tr>
<tr>
<td>hydroxide</td>
<td>$\text{OH}^-$</td>
<td>-1</td>
</tr>
<tr>
<td>sulfate</td>
<td>$\text{SO}_4^{2-}$</td>
<td>-2</td>
</tr>
<tr>
<td>ammonium</td>
<td>$\text{NH}_4^+$</td>
<td>+1</td>
</tr>
</tbody>
</table>

Compounds with Polyatomic Ions

- polyatomic ions act as a single group and are treated as a single ion when they combine to form ionic compounds

Ex. Common Polyatomic Ions

Sodium Phosphate – $\text{Na}_3\text{PO}_4$

Number of:
- Sodium ions:
- Phosphorous ions:
- Oxygen ions:

Copper (II) Nitrate – $\text{Cu(NO}_3\text{)}_2$

Number of:
- Copper ions:
- Nitrogen ions:
- Oxygen ions:
- when naming compounds with polyatomic anions, then ending of the polyatomic ion is not changed

Ex. Write the name of Na$_2$CO$_3$.

1. Write the name of the metal first and check whether it is multivalent or not.

2. Write the name of the polyatomic ion second.

Ex. Write the name of Fe(NO$_3$)$_3$.

1. Write the name of the metal first and check whether it is multivalent or not. If the metal is multivalent, determine which of the possible charges satisfies the ratio in the chemical formula.

2. Write the name of the polyatomic ion second.
- When we determine the chemical formula of a compound with a polyatomic ion we treat the polyatomic ion as a single unit.

Ex. What is the chemical formula of lithium phosphate?

What is the chemical formula of copper (II) sulfate?
Assignment:

1. For each compound: i) list the elements and the number of each element in one molecule, ii) name the polyatomic ion in each compound and iii) name the compound.
   a. KNO₃
   b. Ca(OH)₂
   c. CuSO₄
   d. Fe(NO₃)₃
   e. Cu(ClO₃)₂

2. Write the chemical formula for each of the following compounds.
   a. potassium nitrate
   b. barium sulfate
   c. potassium chlorate
   d. copper (II) nitrate
   e. lead (II) sulfate

3. Explain why the chemical formula for calcium hydroxide is written as Ca(OH)₂ and not as CaO₂H₂.

4. Complete the following table by identifying the anions and cations. The first one is done for you.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Cation(s)</th>
<th>Anion(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe(OH)₃</td>
<td>Fe³⁺</td>
<td>3 OH⁻</td>
</tr>
<tr>
<td>Cu(NO₃)₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al₂(SO₄)₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K₃PO₄</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>