### Periodic Table of Ions

<table>
<thead>
<tr>
<th>Ion</th>
<th>Formulas</th>
<th>Common Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{H}^+)</td>
<td>H(_2\text{O})</td>
<td>(\text{H}^+)</td>
</tr>
<tr>
<td>(\text{O}^-)</td>
<td>(\text{OH}^-)</td>
<td>(\text{O}^-)</td>
</tr>
<tr>
<td>(\text{N}_2\text{H}_4)</td>
<td>(\text{NH}_4^+)</td>
<td>(\text{N}^+)</td>
</tr>
<tr>
<td>(\text{H}_3\text{O}^+)</td>
<td>(\text{H}_2\text{O}^+)</td>
<td>(\text{H}^+)</td>
</tr>
<tr>
<td>(\text{SO}_4^{2-})</td>
<td>(\text{SO}_4^{2-})</td>
<td>(\text{SO}_4^{2-})</td>
</tr>
<tr>
<td>(\text{PO}_4^{3-})</td>
<td>(\text{PO}_4^{3-})</td>
<td>(\text{PO}_4^{3-})</td>
</tr>
<tr>
<td>(\text{NH}_4^+)</td>
<td>(\text{NH}_4^+)</td>
<td>(\text{NH}_4^+)</td>
</tr>
<tr>
<td>(\text{OH}^-)</td>
<td>(\text{OH}^-)</td>
<td>(\text{OH}^-)</td>
</tr>
<tr>
<td>(\text{CO}_3^{2-})</td>
<td>(\text{CO}_3^{2-})</td>
<td>(\text{CO}_3^{2-})</td>
</tr>
</tbody>
</table>

### Table of Periodic Table of Ions

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic Number</th>
<th>Mass Number</th>
<th>Electron Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>He</td>
<td>2</td>
<td>4</td>
<td>[He]</td>
</tr>
<tr>
<td>Ne</td>
<td>10</td>
<td>20</td>
<td>[Ne]</td>
</tr>
<tr>
<td>Ar</td>
<td>18</td>
<td>40</td>
<td>[Ar]</td>
</tr>
<tr>
<td>Kr</td>
<td>36</td>
<td>84</td>
<td>[Kr]</td>
</tr>
<tr>
<td>Xe</td>
<td>54</td>
<td>136</td>
<td>[Xe]</td>
</tr>
<tr>
<td>Rn</td>
<td>86</td>
<td>214</td>
<td>[Rn]</td>
</tr>
</tbody>
</table>

### Additional Information

- **Key**
  - **Symbol**: \(\text{S}\)
  - **Atomic Number**: 16
  - **Mass Number**: 32
  - **Electron Configuration**: [Ar] 4s\(^2\) 3p\(^6\)
  - **Atomic Radius**: 180 pm

- **Common Name**: Sulfur

- **Ions**
  - \(\text{S}^2-\), \(\text{S}^-\), \(\text{S}^{2+}\), \(\text{S}^{3+}\), \(\text{S}^{4+}\), \(\text{S}^{5+}\), \(\text{S}^{6+}\)

- **Uses**
  - In fertilizers
  - In detergents
  - In medicine
  - In photography

- **Decay Series**
  - Uranium
  - Thorium
  - Actinium

- **Isotopes**
  - \(\text{S}^{32}\) (99.77%), \(\text{S}^{33}\) (0.04%), \(\text{S}^{34}\) (0.19%)
Activity Series

Activity of metals arranged in order of decreasing activity.

Li
K
Rb
Cs
Ra
Ba
Sr
Ca
Na
La
Ce
Mg
Be
U
Al
Ti
V
Mn
Zn
Cr
Fe
Cd
Tl
In
Co
Ni
Sn
Pb
H
Bi
Cu
Ag
Hg
Pt
Au
Solubility Rules and Identifying a Precipitate

The Solubility Rules

1. Alkali metal (Group IA) compounds are soluble.

2. Ammonium ($\text{NH}_4^+$) compounds are soluble.

3. Nitrates ($\text{NO}_3^-$), chlorates ($\text{ClO}_3^-$), and perchlorates ($\text{ClO}_4^-$) are soluble.

4. Most hydroxides ($\text{OH}^-$) are insoluble.
   The exceptions are the alkali metal hydroxides and $\text{Ba(OH)}_2$.
   $\text{Ca(OH)}_2$ is slightly soluble.

5. Most chlorides ($\text{Cl}^-$), bromides ($\text{Br}^-$) or iodides ($\text{I}^-$) are soluble.
   The exceptions are those containing $\text{Ag}^+$, $\text{Hg}^{2+}$, and $\text{Pb}^{2+}$.

6. Carbonates ($\text{CO}_3^{2-}$), phosphates ($\text{PO}_4^{3-}$) and sulfides ($\text{S}^{2-}$) are insoluble.
   The exceptions are the alkali metals and the ammonium ion.

7. Most sulfates ($\text{SO}_4^{2-}$) are soluble.
   $\text{CaSO}_4$ and $\text{Ag}_2\text{SO}_4$ are slightly soluble.
   $\text{BaSO}_4$, $\text{HgSO}_4$ and $\text{PbSO}_4$ are insoluble.

An Example of Identifying a Precipitate

A solution of barium chloride is mixed with a solution of potassium sulfate and a precipitate forms. Write the reaction and identify the precipitate.

Barium chloride and potassium sulfate are both ionic compounds. We would expect them to undergo a double displacement reaction with each other.

$$\text{BaCl}_2 + \text{K}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2 \text{KCl}$$

By examining the solubility rules we see that, while most sulfates are soluble, barium sulfate is not. Because it is insoluble in water we know that it is the precipitate. As all of the other substances are soluble in water we can rewrite the equation.