**Preparation of Salts**

The method of preparation of salt depends on whether the salt is soluble in water or not.

**Soluble and insoluble salts:**

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<th>Salt</th>
<th>Soluble/Insoluble</th>
<th>Exceptions</th>
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<tbody>
<tr>
<td>Nitrates</td>
<td>Soluble</td>
<td>Silver</td>
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<tr>
<td>Chlorides</td>
<td>Soluble</td>
<td>Lead, Mercury</td>
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<tr>
<td>Sulphates</td>
<td>Soluble</td>
<td>Barium, Lead, Calcium</td>
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<tr>
<td>Carbonates</td>
<td>Insoluble</td>
<td>Sodium, Potassium, Ammonium</td>
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</table>

All sodium, potassium and ammonium salts are **soluble**

1. **Preparation of soluble salts:**

**Soluble salts** are prepared by reacting **insoluble solid** with **dilute acid**.

The insoluble solid can be a  
- Metal  
- Base  
- Carbonate

- Reacting dilute acid with a fairly reactive metal

A fairly reactive metal such as magnesium, zinc and iron can be used. For metals below hydrogen in the reactivity series, no reaction occurs. Metals more reactive produce very vigorous reactions which are dangerous to carry in the lab.

\[
\text{Dilute Acid} + \text{Metal} \rightarrow \text{Metal Salt} + \text{Hydrogen gas}
\]

E.g. The preparation of zinc sulphate:

\[
\text{Dilute Sulphuric acid} + \text{Zinc} \rightarrow \text{Zinc Sulphate} + \text{Hydrogen}  \\
H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2
\]
Step 1:
Add excess zinc is added to dilute acid in beaker until reaction stops (no fizzing)

Step 2:
Filter off the excess zinc and collect the filtrate.

Step 3:
Evapourate off most of the water using a hot water bath
Leave the remaining solution to cool down and the salt to crystallize out. Filter the crystals and dry them on filter paper.
• Reacting a dilute acid with an **Insoluble** base

The reaction here is the same as in 1) but with heating to speed up the reaction. The base neutralizes the acid.

\[
\text{Dilute Acid} + \text{Insoluble Base} \rightarrow \text{Metal Salt} + \text{Water}
\]

e.g. Preparation of copper (II) sulphate

\[
\text{Sulphuric Acid} + \text{Copper Oxide} \rightarrow \text{Copper Sulphate} + \text{Water}
\]
\[
H_2SO_4 + CuO \rightarrow CuSO_4 + H_2O
\]

• Reacting dilute acid with an **insoluble** carbonate

The procedure is the same as in 1)

\[
\text{Dilute Acid} + \text{Insoluble Carbonate} \rightarrow \text{Metal Salt} + \text{Water} + \text{Carbon Dioxide}
\]

e.g. Preparation of Calcium Chloride

\[
\text{Hydrochloric Acid} + \text{Calcium Carbonate} \rightarrow \text{Calcium Chloride} + \text{Water} + \text{Carbon Dioxide}
\]
\[
2HCl + CuCO_3 \rightarrow CuCl_2 + H_2O + CO_2
\]

• Reacting dilute acid with an **alkali** (soluble base)

\[
\text{Dilute Acid} + \text{Alkali} \rightarrow \text{Metal Salt} + \text{Water}
\]

E.g. Preparation of sodium chloride

\[
\text{Hydrochloric Acid} + \text{Sodium Hydroxide} \rightarrow \text{Sodium Chloride} + \text{Water}
\]
\[
HCl + NaOH \rightarrow NaCl + H_2O
\]
Procedure (this is called titration):

**Step 1:**
Fill a burette with dilute acid to zero mark.

**Step 2:**
Put 25 cm$^3$ of dilute sodium hydroxide into a conical flask with a pipette.

**Step 3:**
Add few drops of a suitable indicator such as universal indicator.

**Step 4:**
Run the acid from the burette into the flask of alkali until one or more drop of acid is enough to turn the indicator from violet to green.

**Step 5:**
The volume of acid used to neutralize the 25 cm$^3$ of alkali is noted. E.g. 23 cm$^3$ of HCl

**Step 6:**
The process is repeated with the volume noted for the acid and the same volume of alkali used, but without the indicator.

**Step 7:**
Evapourate most of the water from the solution using a hot water bath in a crystallizing dish.

Let the solution cool and crystallize out. Filter the crystals on a filter paper and dry them.
2. Preparation of insoluble salts:

Insoluble salts are prepared by mixing 2 soluble salts together, each containing half the needed salt.

This process is called **precipitation**.

E.g. Preparation of insoluble lead sulphate (PbSO₄):

**Step 1:**

Choose 2 suitable soluble salts, e.g. lead nitrate and sodium sulphate. Make aqueous solutions of both.

![Diagram of aqueous solutions](image)

**Step 2:**

Mix the two aqueous solutions together. An insoluble precipitate of lead sulphate is formed.

![Final mixture](image)
Step 3:
Filter the solution formed to get lead sulphate in filter paper.

\[
\text{Lead Nitrate} + \text{Sodium Sulphate} \rightarrow \text{Lead Sulphate} + \text{Sodium Nitrate}
\]
\[
Pb(NO_3)_2 + Na_2SO_4 \rightarrow PbSO_4 + 2NaNO_3
\]

Step 4:
Wash the filter paper with distilled water to remove trace of soluble salt.

Step 5:
The filter paper is dried in a warm oven. The salt is then scraped off it.