

Lab (7)

Testing for positively charged ions

By

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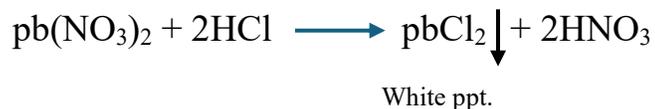
Testing for positively charged ions

To detect cations, we shall use a simplified system involving the separation of metals into a number of groups based upon differences in the solubility of their salts under various conditions. The system should be used only in case on cation is present, it is not suitable to analyses a mixture.

Group	Cations
A	Ag^+ , Pb^{2+}
B	Bi^{3+} , Fe^{3+} , Mn^{2+} , Al^{3+} , Cr^{3+}
C	Ba^{2+} , Sr^{2+} , Ca^{2+}
D	Ni^{2+} , Cu^{2+} , Mg^{2+} , Zn^{2+}

1- Group A:

The chloride salts of group A cations that will be analyzed in this experiment are highly soluble. Therefore, addition of aqueous HCl will result in a precipitate containing chlorides of the group A cations.



To test for Lead ions (Pb^{+2}):

- Put 10 drops from $\text{pb}(\text{NO}_3)_2$ solution in the test tube
- add 5 drops of dilute hydrochloric acid (6 M HCl) to the sample

Observe and record the results.

Confirmatory test: put $\text{Pb}(\text{NO}_3)_2$ solution in test tube then add 3 drops of K_2CrO_4 to form yellow ppt.



2- Group B:

The hydroxides of the cations in group B are almost completely insoluble.

Aluminium ions (Al^{3+}): A few drops of dilute sodium hydroxide solution react to form a white precipitate with aluminium ions



To test for aluminium ions:

- Put 10 drops from $\text{Al}(\text{NO}_3)_3$ solution in the test tube
- add 5 drops of NaOH to the sample

Observe and record the results. Add excess aqueous sodium hydroxide to determine if precipitate is soluble.

With excess NaOH , aluminium hydroxide reacts to form a soluble complex salt, sodium aluminate, NaAlO_2 .

Iron(II) (Fe^{+2}) and Iron(III) (Fe^{+3}) ions:

The precipitate formed in each of the reactions is the hydroxide of the metal ion.



green ppt.



red-brown ppt.

To test for iron ions:

- Put 10 drops from Fe^{+3} or Fe^{+2} solution in the test tube
- add 3 drops of NaOH to the sample

Observe and record the results.

If we used the Iron (II), Fe^{2+} the precipitate colour formed is green. While if we used the Iron (III), Fe^{3+} the precipitate colour formed is brown.

3- Group C:

Cations of group C form insoluble salts with aqueous sodium hydroxide.

Calcium ion (Ca^{+2}): When sodium hydroxide is added to a solution containing Ca^{2+} ions, a white precipitate, calcium hydroxide $\text{Ca}(\text{OH})_2$ is formed. The white precipitate is insoluble in excess NaOH solution.



White ppt.

To test for Calcium ions:

- Put 10 drops from Ca^{+2} solution in the test tube
- add 3 drops of sodium hydroxide (NaOH) solution to the sample

Observe and record the results.

Distinguishing between aluminium ions and calcium ions

A few drops of dilute sodium hydroxide solution react to form a white precipitate with aluminium ions and with calcium ions. However, if excess sodium hydroxide solution is added:

- the aluminium hydroxide precipitate reacts to form a colourless solution
- the calcium hydroxide precipitate is unchanged

4-Group D:

Copper ion (Cu^+): copper sulfate solution reacts with a few drops of sodium hydroxide solution to form a blue precipitate of copper hydroxide.



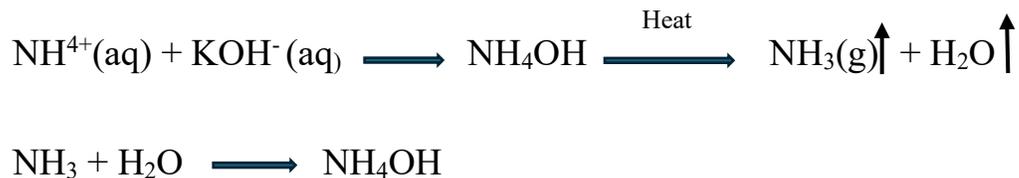
To test for copper ions:

- Put 10 drops from CuSO_4 solution in the test tube
- add 5 drops of NaOH to the sample

Observe and record the results.

5- Ammonium ion (NH_4^+):

Ammonium ions, NH_4^+ , react with hydroxide ions to form ammonia and water:



This gives a test for ammonium ions:

- Add 10 drops from NH_4^+ solution to the sample
- add KOH and put litmus paper (red) on the lip of the test tube.
- warm the mixture for 3 min. notice the change in color.

Ammonia gas is given off if ammonium ions are present.

Testing for ammonia

Ammonia turns damp red litmus paper blue.