

TESTING for IONS

and USES of CHLORINE and CHLORATE(I)

HALIDES

Silver nitrate can be used to test for the presence of halide ions in a solution.



AgX, the silver halide produced in these reactions, is insoluble, so precipitates out of solution.

The AgX precipitate can be used to identify which halide was in the solution, by either

1. the colour of the precipitate, though this can be quite hard, or
2. the solubility in ammonia

Colour	Solubility in NH_3
AgCl	White solution
AgBr	Pale cream solution
AgI	Insoluble in ammonia at any concentration

ALKALINE EARTH METALS

Group 2 ions can be identified using two tests.

Test 1: Add sulfuric acid

Solubility of the group 2 sulfates decreases down the group.

Solution	Observation
MgCl_2	No visible reaction
CaCl_2	No visible reaction
SrCl_2	Faint white precipitate
BaCl_2	Thick white precipitate

Test 2: Add sodium hydroxide

Solubility of the group 2 hydroxides increases down the group.

Solution	Observation
MgCl_2	Thick white precipitate
CaCl_2	Faint white precipitate
SrCl_2	No observation
BaCl_2	No observation

AMMONIUM (NH_4^+)

NH_4^+ can be identified by adding sodium hydroxide to the solution and testing any gas released with red litmus paper or universal indicator paper, which turns blue in the presence of the basic ammonia.



HYDROXIDE (OH^-)

Hydroxide ions can be tested for using red litmus or universal indicator (UI) paper, which turn blue in the presence of basic hydroxide ions.

CARBONATE (CO_3^{2-})

Carbonate ions cause limewater to turn cloudy.

SULFATE (SO_4^{2-})

Sulfate ions are tested for using hydrochloric acid followed by barium chloride.

Hydrochloric acid removes any carbonate ions, which form carbon dioxide.

A white precipitate of BaSO_4 is formed when Ba^{2+} ions are added.



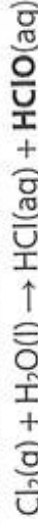
TESTING FOR IONS SUMMARY

Gr.7	NH_4^+	OH^-	CO_3^{2-}	SO_4^{2-}	Gr.2
Silver nitrate	Sodium hydroxide	Litmus/UI	Limewater	HCl then BaCl_2	H_2SO_4 NaOH

CHLORINE AND CHLORATE(I)

CHLORINE AND WATER

Chlorine reacts with water to form hydrochloric acid and hypochlorous acid:



This is a **disproportionation reaction** because Cl is both oxidised and reduced in the same reaction.

HClO is unstable, and sunlight can cause it to decompose into hydrogen and chloride ions alongside oxygen gas.



Chlorine species	Oxidation state of chlorine
chlorine	0
chloride	-1
chlorate(I)	+1

CHLORINE AND SODIUM HYDROXIDE

Chlorine performs a disproportionation reaction with cold, dilute, aqueous sodium hydroxide:



Note: the reaction with hot, concentrated sodium hydroxide forms NaClO_2 , sodium chlorate (IV).

Chlorine species	Oxidation state of chlorine
chlorine	0
chloride	-1
chlorate(V)	+1

Sodium chlorate(I) (NaClO) is used:

- as a weedkiller
- to quickly generate oxygen, such as for emergencies in aeroplane cabins to create ClO_2 , which can be used to bleach paper

WATER TREATMENT

Chlorine and ozone are both used to kill bacteria in water supplies. Both have advantages:

Cl_2 chlorine	O_3 ozone
cheap	tasteless
easy to store	

Chlorine facts:

- toxic to humans in high enough quantities
- only low concentrations are needed to kill bacteria
- if the bacteria were not killed, water would be a lot more unsafe to drink