Halides

4.8.3.4 · Chemical analysis · revision notes

Halide ions (chloride, bromide and iodide) are identified with silver nitrate solution after adding dilute nitric acid; the colour of the silver halide precipitate tells you which ion is present. This is in GCSE Chemistry only (not Combined Science).

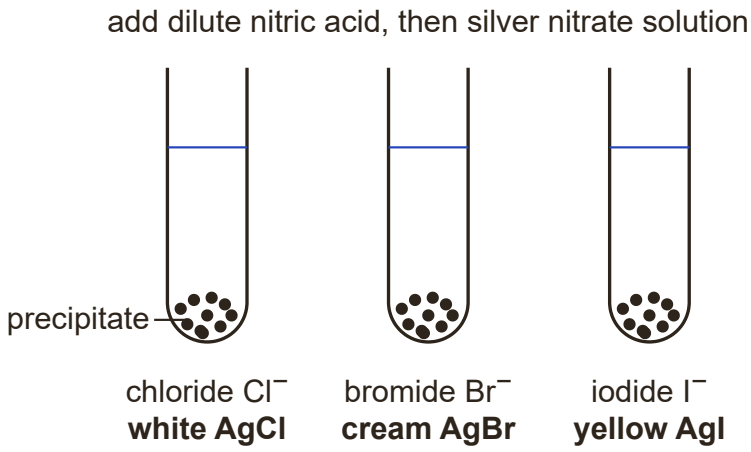
Key facts

- Test: dilute nitric acid, then silver nitrate solution
- Br^- → cream precipitate (AgBr)
- Nitric acid removes carbonate ions, which would also form a precipitate
- Grade 7+ only $Ag^+(aq) + X^-(aq) \rightarrow AgX(s)$, where X = Cl, Br or I
- Cl^- → white precipitate (AgCl)
- I^- → yellow precipitate (AgI)
- Never use hydrochloric acid: it adds chloride ions

Notes

The test

- Halide ions are the negative ions of Group 7 elements: chloride Cl^-, bromide Br^- and iodide I^-.
- Make a solution of the sample. Add a few drops of **dilute nitric acid**, then a few drops of **silver nitrate solution**.
- A silver halide **precipitate** forms. Its colour identifies the halide ion:
- **Chloride**: **white** precipitate of silver chloride.
- **Bromide**: **cream** precipitate of silver bromide.
- **Iodide**: **yellow** precipitate of silver iodide.



Colour of the silver halide precipitate: white, cream, yellow.

Why dilute nitric acid?

- The acid reacts with any carbonate ions and removes them. Carbonate ions would otherwise also form a precipitate with silver nitrate, giving a false positive.
- Do **not** use hydrochloric acid: it contains chloride ions, so you would always get a white precipitate of silver chloride.

Equations

- Example: $NaBr(aq) + AgNO_3(aq) \rightarrow AgBr(s) + NaNO_3(aq)$
- Ionic equations leave out the spectator ions: $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$. Bromide and iodide are the same, giving AgBr(s) and AgI(s). Grade 7+ only

How to answer each type of question

Describe the test for a halide ion and give the result — 2 to 3 marks — Grade 4

1. Add dilute nitric acid to a solution of the sample.
2. Add silver nitrate solution.
3. Give the colour of the precipitate for the ion in the question.

Example. Describe a test to show that a solution contains bromide ions. Give the result.

Model answer. Add dilute nitric acid (1), then silver nitrate solution (1). A cream precipitate forms (1).

Identify a compound from test results — 2 to 4 marks — Grade 6

1. Find the metal ion from its test (flame test or sodium hydroxide solution).
2. Find the halide ion from the colour of the silver halide precipitate.
3. Combine them to name the compound.

Example. A white solid gives a lilac flame in a flame test. A solution of the solid gives a yellow precipitate with dilute nitric acid and silver nitrate solution.
(a) Name the solid.
(b) Write the ionic equation for the formation of the yellow precipitate. Include state symbols.

Model answer.

(a) potassium (1) iodide (1)

(b) $Ag^+ + I^- \rightarrow AgI$ (1); state symbols (aq) + (aq) → (s) (1)

Explain the choice of acid 2 marks **Grade 6**

1. Why add acid at all: it removes carbonate ions, which would also give a precipitate.
2. Why nitric, not hydrochloric: hydrochloric acid adds chloride ions, which give a white precipitate whatever the sample.

Example. A student tested a solution for chloride ions by adding dilute hydrochloric acid and then silver nitrate solution. A white precipitate formed.
Explain why this result does **not** show that the solution contained chloride ions.

Model answer. Hydrochloric acid contains chloride ions (1), so a white precipitate of silver chloride would form even if the solution had no chloride ions of its own; dilute nitric acid should have been used (1).

Don't lose marks

- Using hydrochloric acid instead of nitric acid.
- Mixing up the colours: bromide is cream, iodide is yellow. Use the spec words.
- Giving a colour without saying that a precipitate forms.
- Writing 'chlorine' instead of 'chloride'. The test identifies halide ions, not halogen molecules.

More tips

Memory tricks

- Down Group 7, the precipitate gets darker: chloride white → bromide cream → iodide yellow.
- Silver nitrate goes with nitric acid: nitrate ions do not form a precipitate, so they cannot confuse the result.
- Order of adding: 'nitric first, then silver'.

Exam technique

- Name both reagents: dilute nitric acid AND silver nitrate solution.
- In 'identify the compound' questions, name the metal ion and the halide ion, e.g. 'sodium bromide'.
- In ionic equations, include only Ag^+ and the halide ion, and put (s) after the precipitate.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 **Recall the silver halide precipitate colours**
Chloride white, bromide cream, iodide yellow.

Grade 4 **Describe the test for halide ions**
Add dilute nitric acid, then silver nitrate solution, to a solution of the sample.

Grade 5 **Identify a compound from two ion tests**
Combine the metal ion test result with the halide test result, e.g. lilac flame + yellow precipitate → potassium iodide.

Explain why nitric acid is added

Grade 6 It removes carbonate ions, which would also form a precipitate with silver nitrate.

Grade 6 **Explain why hydrochloric acid is not used**

It contains chloride ions, which would give a white precipitate every time.

Grade 7 **Write ionic equations for silver halide precipitates**

e.g. $Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$.

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