Anion analysis with precipitation reactions (Item No.: P7511300)

Curricular Relevance

Area of Expertise: Chemistry
Education Level: Age 14-16
Topic: General chemistry - Introduction
Subtopic: Test reactions
Experiment: Anion analysis with precipitation reactions

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	20 Minutes	2 Students

Additional Requirements:

Experiment Variations:

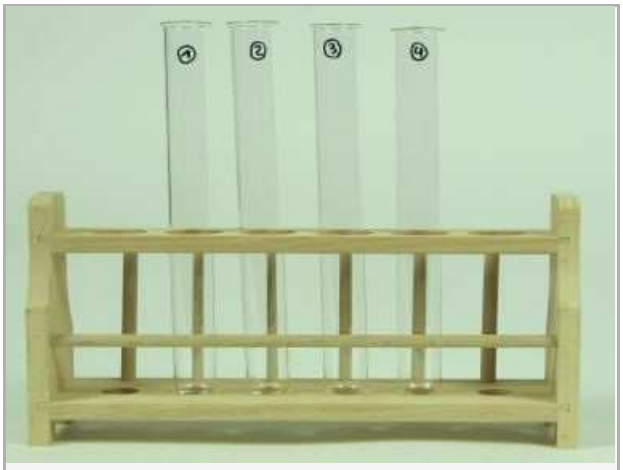
Keywords:

Anions, Detection reactions, Precipitation

Information for teachers

Introduction

Application
Detection reactions for anions are tests in which one can determine an anion (or anions) in a sample. This experiment focuses on the direct detection with precipitation reactions.



Experiment set-up

Educational objectives
The aim of this experiment is to introduce the students to precipitation reactions.

Task
The students have to conduct precipitation reactions to determine various anions.

Prior knowledge
The students should have already gained basic knowledge about salts and their solubility. They should be able to deduce the chemical equations of the precipitation reactions used in this experiment.

Principle
Precipitants are substances or a mixture of substances, which induce the precipitation of dissolved substances to insoluble solids, the precipitate. Precipitation experiments are often used everyday laboratory practice to identify minor ion concentrations.

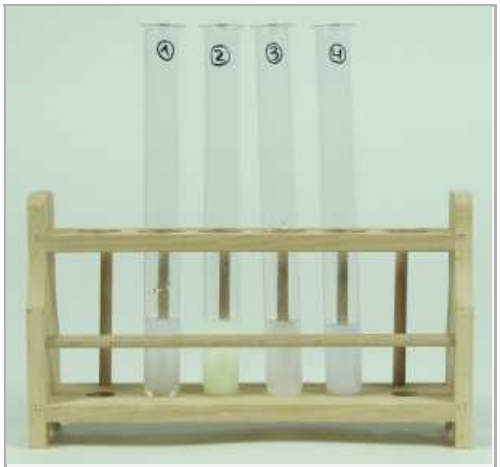
Notes concerning the set-up and execution of the experiment
Prepare a 0.1 M solution of the salts 1-4.
0.1 M sodium chloride solution: 1.46 g sodium chlorid in 250 ml distilled water
0.1 M sodium iodide solution: 2.57 g sodium bromide in 250 ml distilled water
0.1 M sodium sulfate solution: 3.55 g sodium sulfate in 250 ml distilled water
0.1 M sodium carbonate solution: 2.64 g sodium carbonate in 250 ml distilled water

Prepare a hydroacid solution, 5%. First add 40 ml distilled water to a suitable volumetric flask, pipet 13 ml of a 37% hydroacid and dilute to 100 ml with distilled water.
Prepare a nitric acid solution, 5%. First add 40 ml distilled water to a suitable volumetric flask, pipet 50 ml of a 10% nitric acid and dilute to 100 ml with distilled water.
Also prepare a barium chloride solution, 10%. Add 10 g barium chloride to 100 ml distilled water.

Disposal

- Precipiation of barium chloride can be collected in tanks for heavy metal waste for disposal.
- Collect silver chloride and retransform to silver nitrate.
- The other solutions can be collected in a tank for waste acids and bases for disposal.

Results



Exemplary-result

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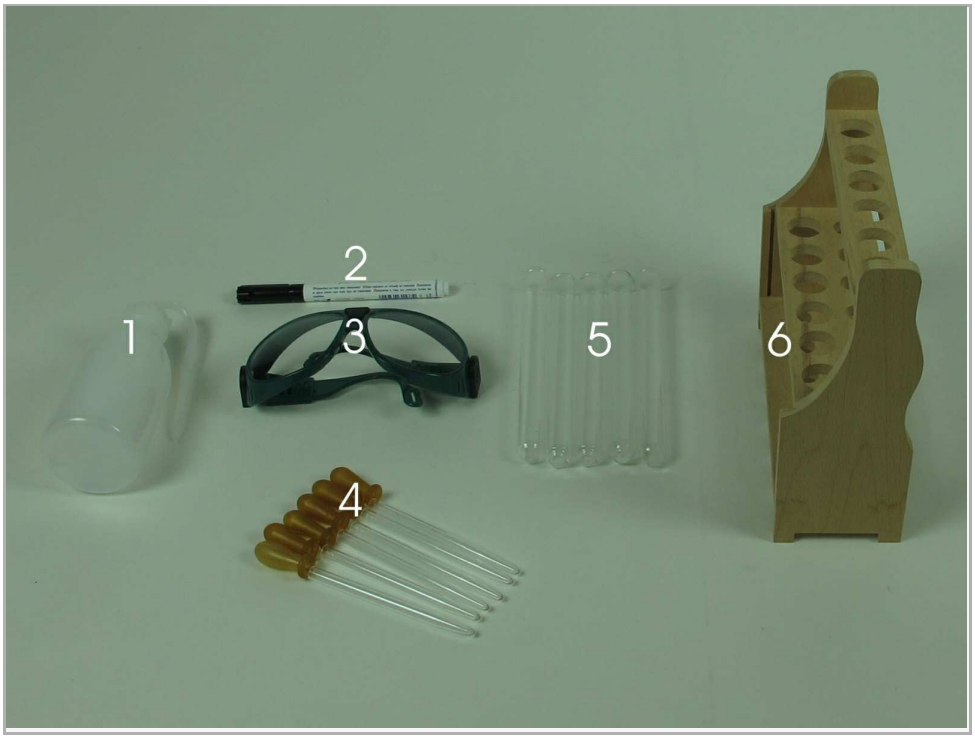
Equipment

Position No.	Material	Order No.	Quantity
1	Wash bottle, 250 ml, plastic	33930-00	1
2	Laboratory pencil	38711-00	1
3	Protecting glasses, clear glass	39316-00	1
4	Pipette with rubber bulb	64701-00	6
5	Test tube, 180x18 mm,100 pcs	37658-10	(4)
6	Test tube rack f. 6 tubes, wood	37685-10	1
	Barium chloride, 250 g	30033-25	
	Sodium bromide, 100 g	30153-10	
	Sodium carbonate, anhyd. 250 g	30154-25	
	Sodium chloride, 250 g	30155-25	
	Sodium sulphate, 500 g	30166-50	
	Silver nitrate solution 5% 100 ml	30223-10	
	Water, distilled, 5 l	31246-81	
	Nitric acid, 10%, tech.gr.,1000ml	31817-70	
	Hydrochloric Acid, 37%, 1000 ml	31828-70	



Safety information




Hazard and precautionary statements

Hydrochlorid acid (5%)	
H314:	Causes severe skin burns and eye damage.
H335:	May cause respiratory irritation.
H290:	May be corrosive to metals.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P330 + P331:	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P309 + P310:	IF exposed or you feel unwell: Immediately call a POISON CENTER or doctor/physician.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
Nitric acid (5%)	
H272:	May intensify fire; oxidizer.
H314:	Causes severe skin burns and eye damage.
P220:	Keep/Store away from clothing/.../combustible materials.
P260:	Do not breathe dust/fume/gas/mist/vapours/spray.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. continue rinsing.
P301 + P330 + P331:	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P309 + P310:	IF exposed or you feel unwell: Immediately call a POISON CENTER or doctor/physician.
Silver nitrate solution (5%)	
H410:	Very toxic to aquatic life with long lasting effects.
H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
P273:	Avoid release to the environment.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P310:	Immediately call a POISON CENTER or doctor/physician.
Sodium iodide	
H400:	Very toxic to aquatic life.
P262:	Do not get in eyes, on skin, or on clothing.
P272:	Contaminated work clothing should not be allowed out of the workplace.
Barium chloride (10%):	
H301:	Toxic if swallowed.
P262:	Do not get in eyes, on skin, or on clothing.
P272:	Contaminated work clothing should not be allowed out of the workplace.
Sodium carbonate	
H319:	Causes serious eye irritation.
P260:	Do not breathe dust/fume/gas/mist/vapours/spray.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.

Hazards

- Acids and bases have a strong irritating effect!
- Wear protective glasses!

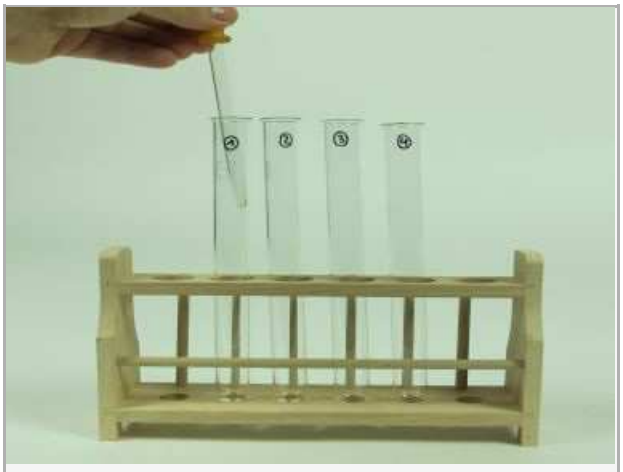
Anion analysis with precipitation reactions (Item No.: P7511300)

Introduction

Application and task

How can we determine anions?

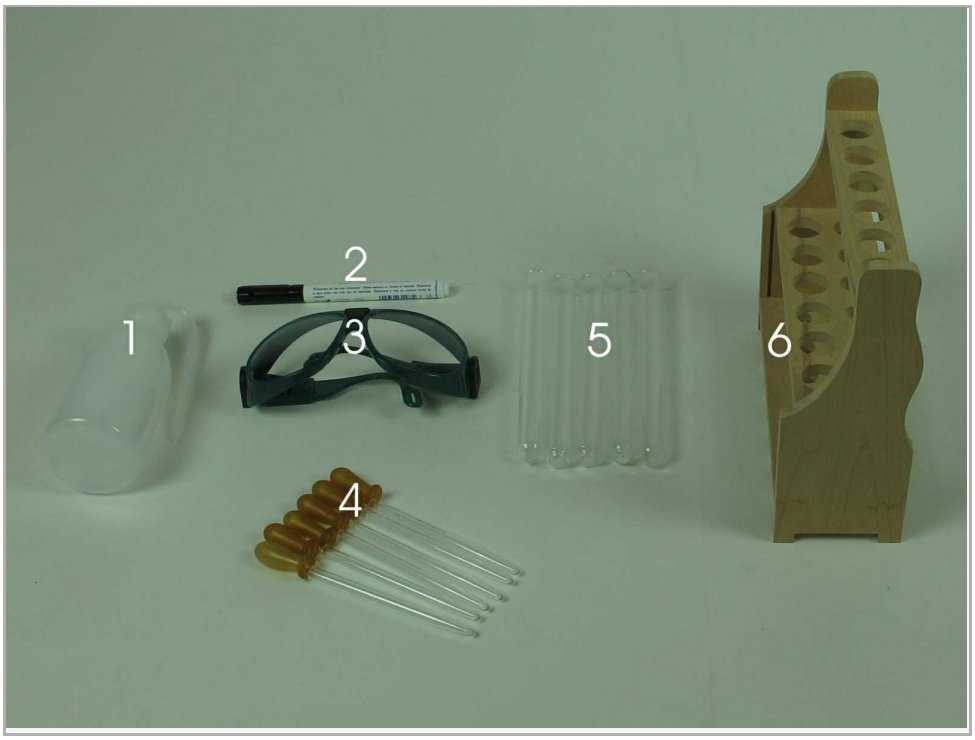
Application
We can determine anions in a sample with precipitation reactions. They are often used in everyday laboratory practice to identify minor ion concentrations. Furthermore, they play an important role in wastewater treatment plants as they remove disruptive ions.



Experiment set-up

Task
Fill the numbered test tubes with the provided salt solutions and conduct the precipation reaction, which are described in the procedure. Make a note of your observations in the report.

Equipment



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Set-up and procedure

Set-up

Hazards

- Acids have a strong irritating effect!
- Wear protective glasses!




Set-up
Number test tubes from 1 to 4 (Fig. 1).

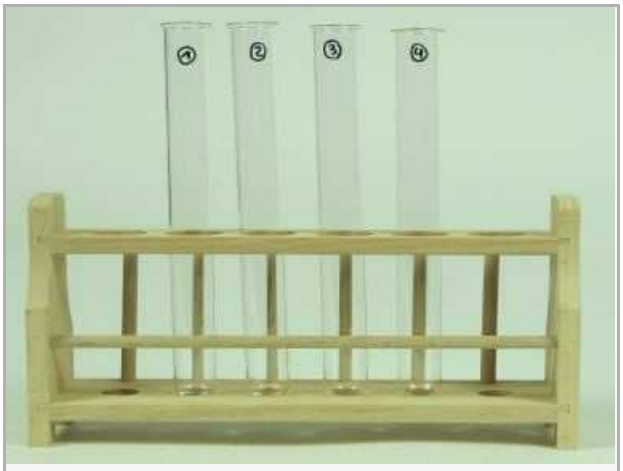

Fig. 1

Use a pipette to fill each test tube with one of the salt solutions (see below).
You must use an individual pipette for each salt solution (Fig. 2).

1. Sodium chloride
2. Sodium bromide
3. Sodium sulfate
4. Sodium carbonate

Rinse the used pipettes with distilled water.

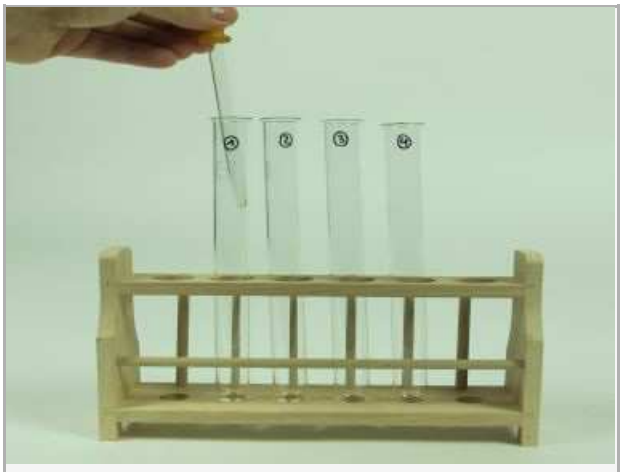

Fig. 2

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Procedure

Procedure

Conduct the precipitation reactions, which are described in detail below (Fig. 3).

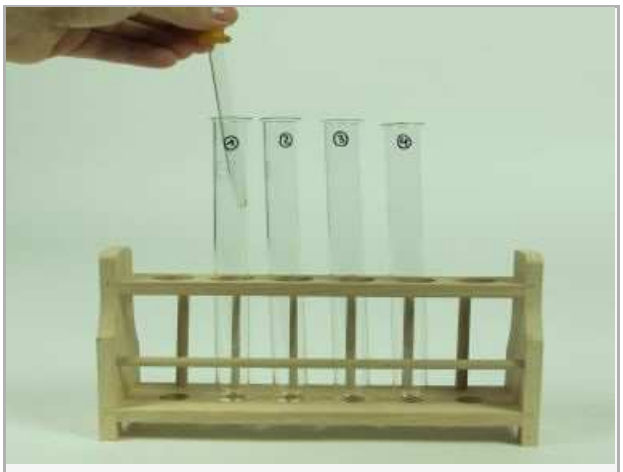

Fig. 3

The precipitation reactions

Use a new pipette for each chemical.

Test tube 1
Add 3 drops of 0.1 M nitric acid to test tube 1. Shake the solution carefully. Add 3 drops of 0.1 M silver nitrate solution. Note your observation.

Test tube 2
Add 3 drops 0.1 M nitric acid to test tube 2. Shake the solution carefully. Add 3 drops of 0.1 M silver nitrate solution. Note your observation.

Test tube 3
Add 3 drops of hydrochloride acid, 5 % to test tube 3. Shake the solution carefully. Add 3 drops of barium chloride, 10 %. Note your observation.

Test tube 4
Add 3 drops of barium chloride, 10 % to test tube 4. Shake the solution carefully. Note your observation.

Disposal

- Precipiation of barium chloride can be collected in tanks for heavy metal waste for disposal.
- Collect silver chloride and retransform to silver nitrate.
- The other solutions can be collected in a tank for waste acids and bases for disposal.

Report: Anion analysis with precipitation reactions

Result - Table 1

Enter your observations in the table.

Test tube	Observation
1	white precipitate [1]
2	yellow precipitate [1]
3	white precipitate [1]
4	white precipitate [1]

Evaluation - Question 1

What are the chemical equations to the precipitation reactions in test tube 1 and 3 ?

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Evaluation - Question 2

Which anion did you determine in each test tube?

1.
2.
3.
4.

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