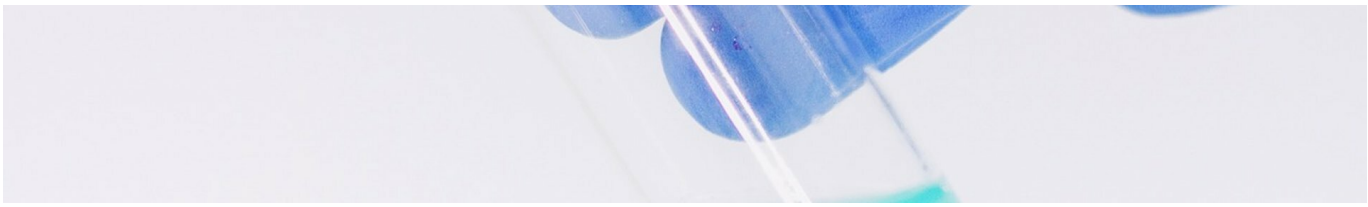


Precipitation of sediment pt 1

- Precipitation of sediment pt 1
- Lesson plan (Polish)
- Lesson plan (English)

Testing tube
Source: domena publiczna.

Link to the lesson

Before you start you should know

- that salts are a group of ionic chemical compounds, composed of cations of metals and anions of an acid radical;
- that there are salts which dissolve in water and those which are sparingly soluble or practically insoluble in water;
- that based on the solubility table it can be determined whether ions present in the solution will react with each other, a chemical compound that is sparingly soluble in water.

You will learn

- to predict whether mixing of substances that undergo dissociation will (or will not) create a sparingly soluble compound;
- to explain what the precipitation reaction is;
- to present chemical equations for precipitation using molecular, complete ionic and net ionic formulas.

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe abstraktu

What does the precipitation reaction consist of?

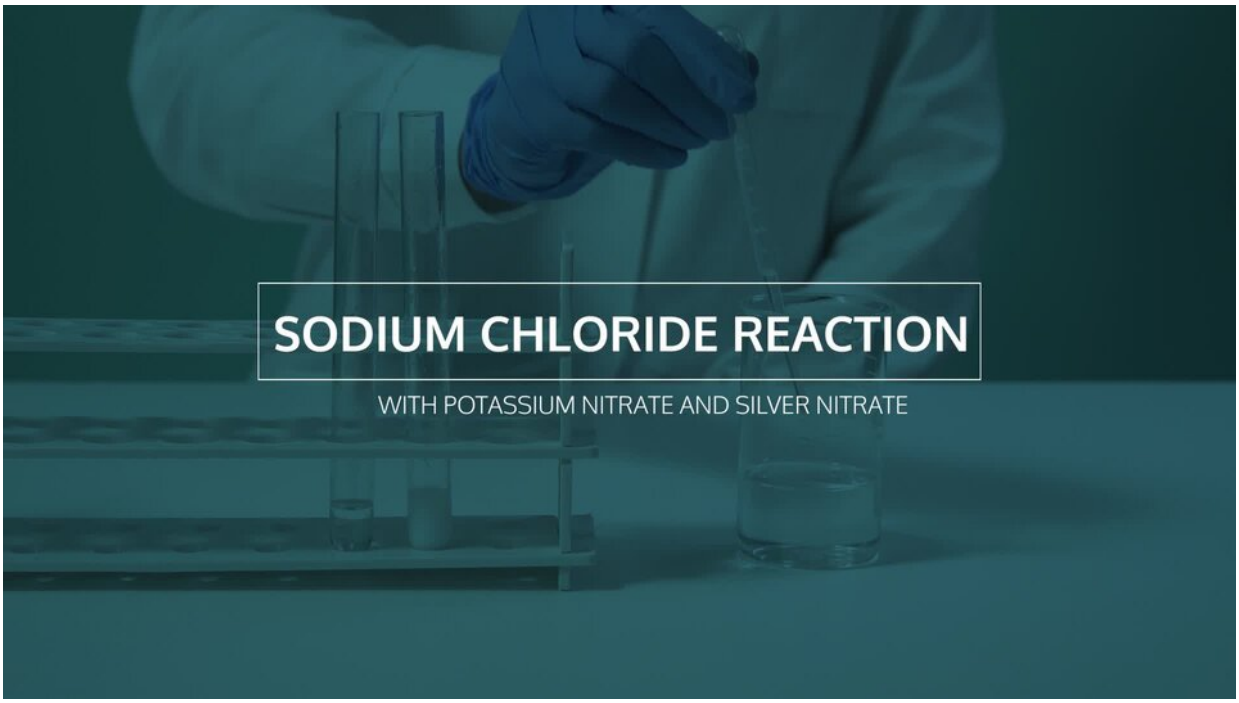
Task 1

Before you watch the movie, formulate the research question and hypothesis.

Analysis of the experiment: Comparison of the reaction of sodium chloride with potassium nitrate and silver(I) nitrate.

Research question

Hypothesis



Film dostępny na portalu epodreczniki.pl

Film pokazuje eksperyment. Problem badawczy: Porównanie przebiegu reakcji chlorku sodu z azotanem pięć potasu i azotanem pięć srebra jeden. Hipotezy: Chlorek sodu reaguje z obiema solami. Chlorek sodu nie reaguje z żadną z podanych soli. Chlorek sodu reaguje tylko z azotanem pięć potasu. Chlorek sodu reaguje tylko z azotanem pięć srebra jeden. Będziesz

potrzebować: probówki, roztwory soli: chlorku sodu, azotanu pięć potasu i azotanu pięć srebra jeden. Instrukcja: Do dwóch probówek wlej takie same objętości (po około dwa–trzy centymetry sześcienne roztworów soli: do pierwszej – azotanu pięć srebra jeden, a do drugiej – azotanu pięć potasu. Do każdej z nich dodawaj kroplami jednakową objętość (pół centymetra sześciennego) roztworu chlorku sodu.

Experiment 1

Research problem

Comparison of the reaction of sodium chloride with potassium nitrate and silver(I) nitrate.

Hypothesis

Select one of the presented hypotheses and then verify it.

Sodium chloride reacts with both salts.
Sodium chloride does not react with any of the salts.
Sodium chloride reacts only with potassium nitrate.
Sodium chloride reacts only with silver(I) nitrate.

You will need

- test tubes,
- solutions of the following salts: sodium chloride, potassium nitrate and silver(I) nitrate.

Instruction

1. Pour the same volume of salt solutions (approx. 2–3 cm^3 each) into two tubes: silver(I) nitrate into the first tube and potassium nitrate into the second one.
2. Drop by drop, add the same volume (0.5 cm^3) of the sodium chloride solution to each of them.
3. Observe the changes that occur.

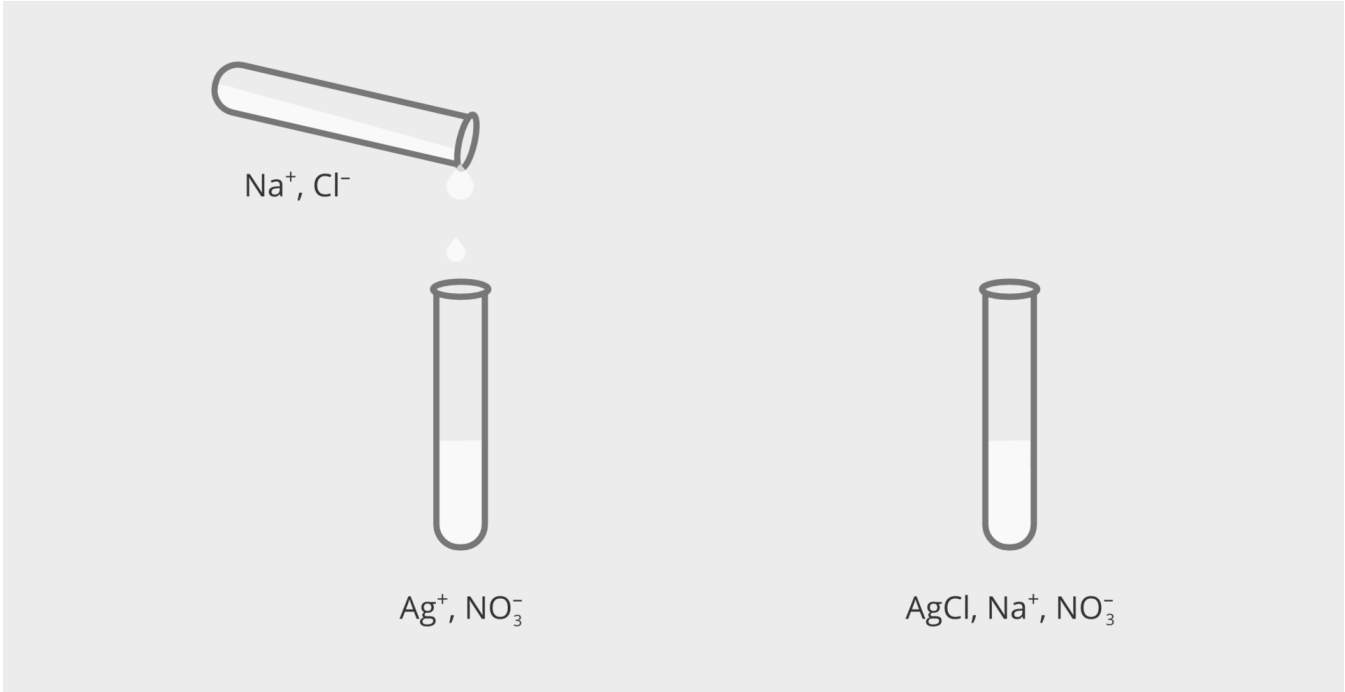
Summary

A white sediment (precipitate) appears in the tube containing silver(I) nitrate after adding the sodium chloride solution. After adding this salt to the potassium nitrate solution, no changes are visible.
Water-soluble salts decompose into ions as a result of the process of electrolytic dissociation. When you mix the solutions of two salts, such as silver(I) nitrate and sodium chloride, the solution contains ions next to each other: Ag^+, NO_3^-, Na^+, Cl^-. Two of them, Ag^+ i Cl^-, will form a salt that is practically water-insoluble – silver(I) chloride. This salt precipitates from the solution in the form of sediment. In the chemical equation, this fact is indicated by an arrow pointing downwards, placed after the salt formula:

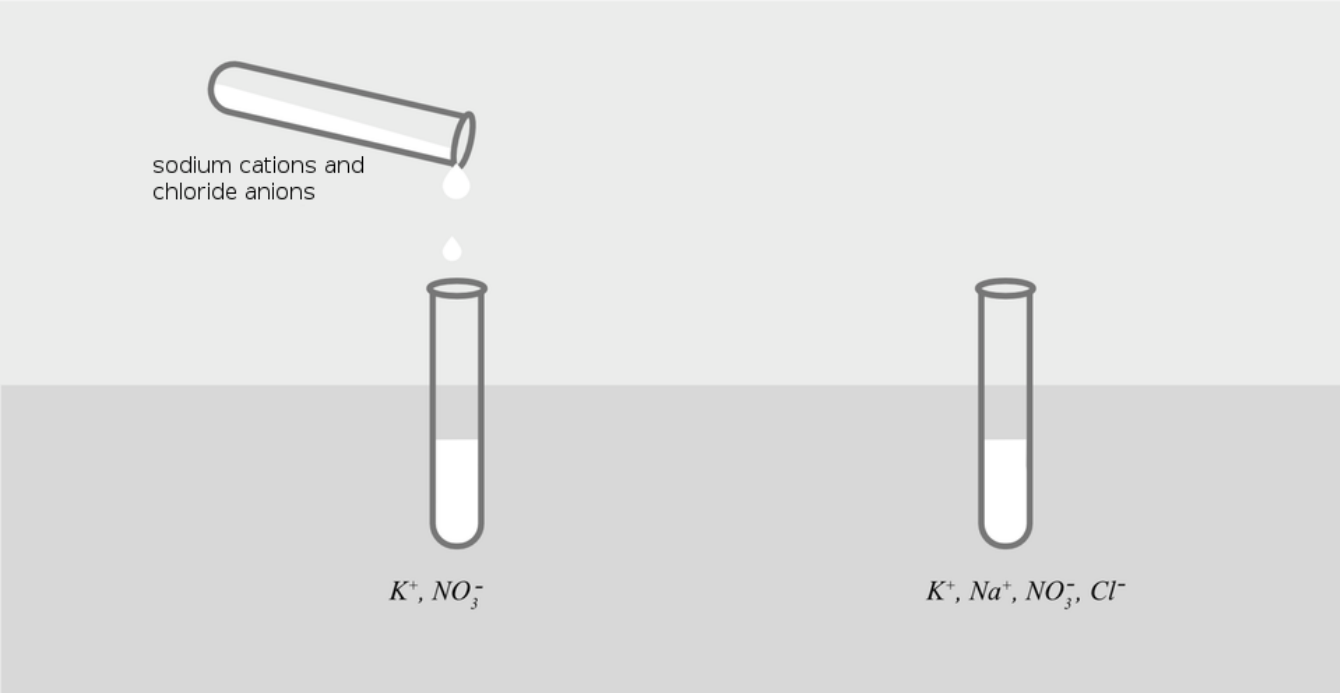
$$AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$$
$$\text{silver(I) nitrate} + \text{sodium chloride} \rightarrow \text{silver(I) chloride} + \text{sodium nitrate}$$

When potassium nitrate and sodium chloride are mixed together, the resulting solution will contain ions: K^+, NO_3^-, Na^+, Cl^-. None of them form together insoluble compounds, therefore the solution after mixing is homogeneous.

A reaction in which a sparingly soluble compound is formed after mixing together the solutions of two soluble substances is called a precipitation reaction. Its essential element is the reaction between some ions formed from dissociation of the substances mixed together.



When sodium chloride is added to the silver nitrate solution chloride anions react with silver cations to form a sparingly soluble salt - silver chloride
Source: GroMar Sp. z o.o., licencja: CC BY 3.0.



Sodium chloride and potassium nitrate(v) do not react with each other
Source: GroMar Sp. z o.o., licencja: CC BY 3.0.

How do we describe a precipitation reaction?

We can present a precipitation reaction in various ways. It will be discussed using the example of the reaction taking place in experiment 1. As you remember, as a result of the reaction of silver nitrate with sodium chloride, silver(I) chloride was precipitated in the form of sediment. This transformation can be described with a chemical equation in molecular form, i.e. containing molecular formulas of compounds:

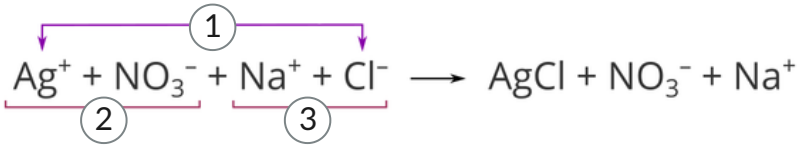
$$\mathrm{AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3}$$
$$\mathrm{silver(I)\ nitrate + sodium\ chloride \rightarrow silver(I)\ chloride + sodium\ nitrate}$$

You remember that the above reaction takes place in an aqueous solution, and the substrates used for the experiment are soluble in water and occur in it in the form of ions. Two of them joined together to form a chemical compound that is sparingly soluble in water. In the equation, we can include the form in which substances occur during the reaction:

$$\mathrm{Ag^+ + NO_3^- + Na^+ + Cl^- \rightarrow AgCl + NO_3^- + Na^+}$$

You already know that this way of expressing a chemical equation, which includes the formulas of all ions present in the reaction mixture, is called a complete ionic equation. In a chemical equation presented in this way, we do not use arrows that symbolize the

formation of sediment, because the method of writing (molecular formula for salt) already informs about the formation of a product that is sparingly soluble (no free ions).

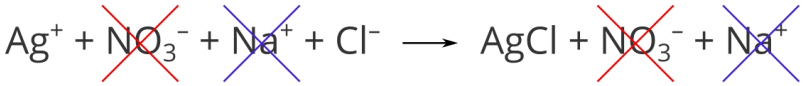


1. formation of sparingly soluble salt

2. silver(I) nitrate solution

3. sodium chloride solution

Note that there are identical ions on the sides of both substrates and products, and that the presented reaction happens only between two types of ions: silver cation and chloride anion. In the complete ionic equation, we can cross out recurring ions on both sides of it:



The scheme of creating the ionic equation shortened on the basis of the ionic equation of the reaction
Source: Krzysztof Jaworski, licencja: CC BY 3.0.

We can therefore write down an equation that contains only symbols of ions that react with each other:

$$Ag^{+} + Cl^{-} \rightarrow AgCl$$

This is a net ionic equation.

Can substances other than salts participate in precipitation reactions?

Experiment 2

Research problem

Do sodium hydroxide and copper(II) sulfate solutions react with each other? If so, what is the effect of this reaction?

Hypothesis

Select one of the presented hypotheses and then verify it.

Sodium hydroxide and copper(II) sulfate solutions do not react with each other.
Mixing the two solutions: sodium hydroxide and copper(II) sulfate will result in a sparingly soluble compound (sediment will be precipitated).

You will need

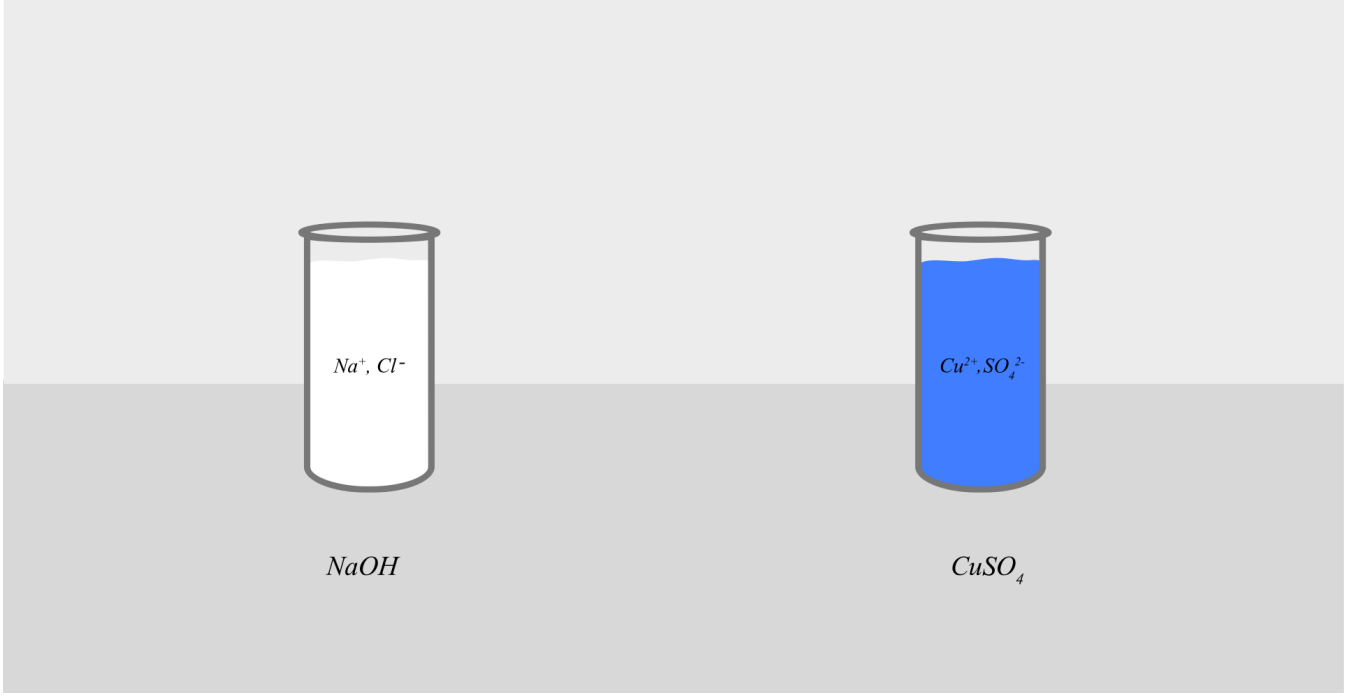
- test tubes,
- solutions of the following substances: sodium hydroxide, copper(II) sulfate.

Instruction

1. Pour 2–3 cm^3 of the salt solution – copper(II) sulfate into a test tube.
2. Add the sodium hydroxide solution to it.
3. Observe the changes that occur.

Summary

A gelatinous blue gelatinous sediment (precipitate) was formed in the tube with the solution of copper(II) sulfate after the addition of the sodium hydroxide solution.
In the solutions of the substances used for the experiment, there were ions formed as a result of dissociation. In the salt solution, these were: cations of copper(II) $\mathrm{Cu^{2+}}$ and anions of sulfate $\mathrm{SO_4^{2-}}$. In the hydroxide solution, these were the following ions: cations of sodium $\mathrm{Na^{+}}$ and hydroxide anions $\mathrm{OH^{-}}$.



Ions contained in the solutions of the substance used in experiment 2
Source: GroMar Sp. z o.o., licencja: CC BY 3.0.

After mixing the two solutions, copper(II) cations and hydroxide anions formed the sparingly water-soluble copper(II) hydroxide:

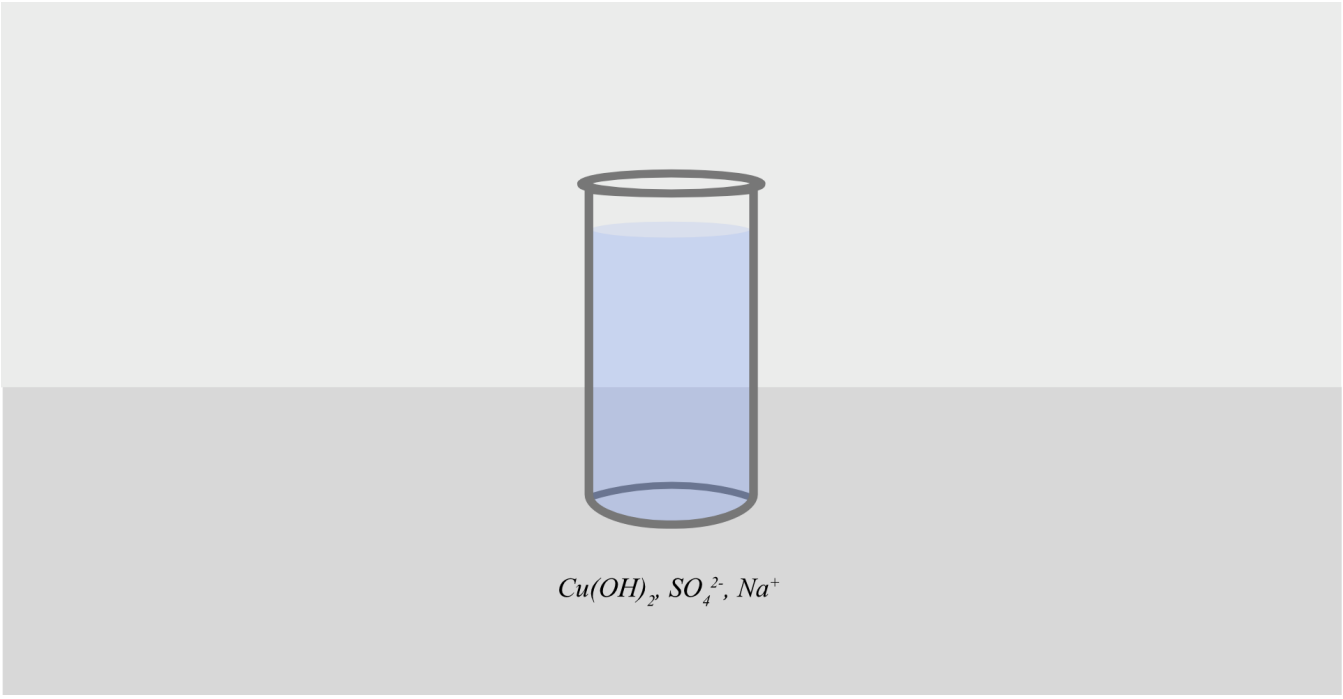
$$\mathrm{CuSO_4 + 2NaOH \rightarrow Cu(OH)_2\downarrow + Na_2SO_4}$$
$$\mathrm{copper(II)\ sulfate + sodium\ hydroxide \rightarrow copper(II)\ hydroxide + sodium\ sulfate}$$

The above reaction takes place between ions, so it can be described with the following complete ionic equation:

$$\mathrm{Cu^{2+} + SO_4^{2-} + 2Na^{+} + 2OH^{-} \rightarrow Cu(OH)_2 + SO_4^{2-} + 2Na^{+}}$$

The net ionic equation for this reaction is as follows:

$$\mathrm{Cu^{2+} + 2OH^{-} \rightarrow Cu(OH)_2}$$



Components of a solution formed after mixing copper(II) sulfate with sodium hydroxide

Exercise 1

Complete the definition.

aqueous, sparingly soluble, is precipitated, ions

Precipitation reaction - a chemical reaction in an ..... solution between ..... from substances mixed together, resulting in the creation of a ..... compound, which ..... from the solution in the form of sediment

Exercise 2

Complete the sentences.

solubility table, react with other salts and hydroxides, salt, Reactions between salts as well as between salts and hydroxides, produces sparingly soluble products, precipitation reactions, will combine into a compound that is sparingly soluble in water

Salts can ..... in an aqueous solution, on condition that this reaction .....
If there is a reaction between two salts, the sparingly soluble product is also a .....
Reactions occurring in an aqueous solution between ions from two different substances, which together form a sparingly soluble compound, are called .....
Precipitation reactions can be predicted on the basis of the ..... by checking whether the ions that will be found in the solution after mixing of two soluble substances .....
..... are examples of an exchange reaction.

Exercise 3

Chemical reaction taking place in an aqueous solution between the ions coming from the mixed substances, leading to the formation of a sparingly soluble compound that precipitates from the solution in the form of a sediment is called:

- precipitation reaction
- synthesis reaction
- sedimentation reaction

Conclusion

- Salts can react with other salts and hydroxides in an aqueous solution, provided that this reaction produces sparingly soluble products.
- If there is a reaction between two salts, the sparingly soluble product is also a salt.

Homework

Task 2.1

How can salt, which is the main component of limestones, be produced in the precipitation reaction? Write the equations of three possible reactions, using molecular, complete ionic and net ionic equations.

Keywords

precipitation reaction, precipitation reaction of sediments, sediment, salt, hydroxide, salts and hydroxides solubility table

Glossary

precipitation reaction

Nagranie dostępne na portalu epodreczniki.pl

nagranie dźwiękowe słówka

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reakcja strąceniowa – reakcja chemiczna zachodząca w roztworze wodnym między jonami pochodzącymi od zmieszanych ze sobą substancji, prowadząca do powstania trudno rozpuszczalnego związku, który wytrąca się z roztworu w postaci osadu

Lesson plan (Polish)

Temat: Wytrącanie osadów cz. 1

Adresat

Uczeń szkoły podstawowej (klasy 7. i 8.)

Podstawa programowa:

Szkoła podstawowa. Chemia.

VII. Sole. Uczeń:

5) wyjaśnia przebieg reakcji strąceniowej; projektuje i przeprowadza doświadczenie pozwalające otrzymywać substancje trudno rozpuszczalne (sole i wodorotlenki) w reakcjach strąceniowych, pisze odpowiednie równania reakcji w formie cząsteczkowej i jonowej; na podstawie tablicy rozpuszczalności soli i wodorotlenków przewiduje wynik reakcji strąceniowej.

Ogólny cel kształcenia

Uczeń wyjaśnia mechanizm reakcji strąceniowej

Kompetencje kluczowe

- porozumiewanie się w językach obcych;
- kompetencje informatyczne;
- umiejętność uczenia się.

Kryteria sukcesu
Uczeń nauczy się:

- przewidywać, czy w wyniku zmieszania roztworów substancji ulegających dysocjacji powstanie, czy też nie utworzy się związek trudno rozpuszczalny;
- wyjaśniać, na czym polega reakcja strącania (strąceniowa);
- przedstawiać równania reakcji strącania za pomocą zapisów cząsteczkowych, jonowych pełnych i jonowych skróconych.

Metody/techniki kształcenia

- **aktywizujące**
    - dyskusja.
- **podające**
    - pogadanka.

- **programowane**
    - z użyciem komputera;
    - z użyciem e-podręcznika.
- **praktyczne**
    - ćwiczeń przedmiotowych.
- **eksponujące**
    - pokaz.

Formy pracy

- praca indywidualna;
- praca w parach;
- praca w grupach;
- praca całego zespołu klasowego.

Środki dydaktyczne

- e-podręcznik;
- zeszyt i kredki lub pisaki;
- tablica interaktywna, tablety/komputery.

Przebieg lekcji

Faza wstępna

1. Nauczyciel rozdaje uczniom metodniki lub kartki w trzech kolorach: zielonym, żółtym i czerwonym do zastosowania w pracy techniką świateł drogowych. Przedstawia cele lekcji sformułowane w języku ucznia na prezentacji multimedialnej oraz omawia kryteria sukcesu (może przesłać uczniom cele lekcji i kryteria sukcesu pocztą elektroniczną lub zamieścić je np. na Facebooku, dzięki czemu uczniowie będą mogli prowadzić ich portfolio).
2. Prowadzący wspólnie z uczniami ustala – na podstawie wcześniej zaprezentowanych celów lekcji – co będzie jej tematem, po czym zapisuje go na tablicy interaktywnej/tablicy kredowej. Uczniowie przepisują temat do zeszytu.

Faza realizacyjna

1. Nauczyciel rozdaje uczniom karty pracy. Informuje ich, że za chwilę obejrzą film z opisanego w abstrakcie doświadczenia „Porównanie przebiegu reakcji chlorku sodu z azotanem(V) potasu i azotanem(V) srebra(I)". Zanim to nastąpi, powinni sformułować pytanie badawcze i hipotezę oraz zapisać je w kartach pracy. Po emisji filmu nauczyciel wraz z uczniami podsumowują obserwacje – uczniowie notują je w kartach pracy. Prowadzący zajęcia zapisuje równania reakcji na tablicy w formie cząsteczkowej, jonowej i jonowej skróconej, a przy tym tłumaczy mechanizm tej reakcji. Uczniowie przepisują równania do kart pracy. Dla utrwalenia wiadomości nauczyciel wyświetla na tablicy

multimedialnej zapis jonowy pełny oraz skrócony równania. Prosi o sformułowanie wynikającego z tego doświadczenia wniosku, który również uczniowie zapisują w kartach pracy. Uwaga: doświadczenie przedstawione w filmie uczniowie mogą także wykonać zgodnie z instrukcją w abstrakcie. Film można wówczas potraktować jako podsumowanie i porównanie rezultatów eksperymentu.
2. Nauczyciel dzieli uczniów na grupy. Podaje każdej instrukcje do doświadczenia 2 z abstraktu – „Czy w reakcjach strącania mogą brać udział inne substancje niż sole" – oraz szkło, sprzęt i odczynniki. Zespoły wykonują doświadczenie, spostrzeżenia zapisują w kartach pracy i rozmawiają o nich na forum klasy. Prowadzący zajęcia prosi chętnych uczniów o zapisanie równań reakcji chemicznych na tablicy – pozostali notują je w kartach pracy. Na podstawie zapisu równań reakcji nauczyciel pyta uczniów o wnioski z tego doświadczenia, które po ustaleniu także zapisują w kartach pracy.
3. W celu utrwalenia wiadomości nauczyciel prosi uczniów (praca w parach) o wykonanie ćwiczeń interaktywnych w abstrakcie.

Faza podsumowująca

1. Nauczyciel prosi uczniów o rozwinięcie zdań:
    - Dziś nauczyłem się...
    - Zrozumiałem, że...
    - Zaskoczyło mnie...
    - Dowiedziałem się...

    W celu przeprowadzenia podsumowania może posłużyć się tablicą interaktywną w abstrakcie lub polecić uczniom pracę z nią

Praca domowa

1. Odsłuchaj w domu nagrania abstraktu. Zwróć uwagę na wymowę, akcent i intonację. Naucz się prawidłowo wymawiać poznane na lekcji słówka.
2. Wykonaj w domu notatkę z lekcji metodą sketchnotingu.

W tej lekcji zostaną użyte m.in. następujące pojęcia oraz nagrania

Pojęcia

> **precipitation reaction**
>
> Nagranie dostępne na portalu epodreczniki.pl
>
> nagranie dźwiękowe słówka
>
> ---

> **reakcja strąceniowa** – reakcja chemiczna zachodząca w roztworze wodnym między jonami pochodzącymi od zmieszanych ze sobą substancji, prowadząca do powstania trudno rozpuszczalnego związku, który wytrąca się z roztworu w postaci osadu

Teksty i nagrania

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe abstraktu

Precipitation of sediment pt 1

A reaction in which a sparingly soluble compound is formed after mixing together the solutions of two soluble substances is called a precipitation reaction. Its essential element is the reaction between some ions formed from dissociation of the substances mixed together.

We can present a precipitation reaction in various ways. It will be discussed using the example of the reaction taking place in experiment 1. As you remember, as a result of the reaction of silver nitrate with sodium chloride, silver(I) chloride was precipitated in the form of sediment. This transformation can be described with a chemical equation in molecular form, i.e. containing molecular formulas of compounds:

$$\mathrm{AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3}$$
$$\mathrm{silver(I)\ nitrate + sodium\ chloride \rightarrow silver(I)\ chloride + sodium\ nitrate}$$

You remember that the above reaction takes place in an aqueous solution, and the substrates used for the experiment are soluble in water and occur in it in the form of ions. Two of them joined together to form a chemical compound that is sparingly soluble in water. In the equation, we can include the form in which substances occur during the reaction:

$$\mathrm{Ag^+ + NO_3^- + Na^+ + Cl^- \rightarrow AgCl + NO_3^- + Na^+}$$

You already know that this way of expressing a chemical equation, which includes the formulas of all ions present in the reaction mixture, is called a complete ionic equation. In a chemical equation presented in this way, we do not use arrows that symbolize the formation of sediment, because the method of writing (molecular formula for salt) already informs about the formation of a product that is sparingly soluble (no free ions).

Note that there are identical ions on the sides of both substrates and products, and that the presented reaction happens only between two types of ions: silver cation and chloride anion. In the complete ionic equation, we can cross out recurring ions on both sides of it:

We can therefore write down an equation that contains only symbols of ions that react with each other:

$$Ag^+ + Cl^- \rightarrow AgCl$$

This is a net ionic equation.

After mixing the two solutions, copper(II) cations and hydroxide anions formed the sparingly water-soluble copper(II) hydroxide:

$$CuSO_4 + 2NaOH \rightarrow Cu(OH)_2\downarrow + Na_2SO_4$$
$$\text{copper(II) sulfate} + \text{sodium hydroxide} \rightarrow \text{copper(II) hydroxide} + \text{sodium sulfate}$$

The above reaction takes place between ions, so it can be described with the following complete ionic equation:

$$Cu^{2+} + SO_4^{2-} + 2Na^+ + 2OH^- \rightarrow Cu(OH)_2 + SO_4^{2-} + 2Na^+$$

The net ionic equation for this reaction is as follows:

$$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$$

- Salts can react with other salts and hydroxides in an aqueous solution, provided that this reaction produces sparingly soluble products.
- If there is a reaction between two salts, the sparingly soluble product is also a salt.

Lesson plan (English)

Topic: Precipitation of sediment pt 1

Target group

Elementary school student (grades 7. and 8.)

Core curriculum:

Primary school. Chemistry.

VII. Salts. Pupil:

5) explains the course of the precipitation reaction; designs and conducts experiments that allow obtaining sparingly soluble substances (salts and hydroxides) in precipitation reactions, writes the appropriate equations of reaction in molecular and ionic form; based on the solubility table of salts and hydroxides, the result of the precipitation reaction.

General aim of education

The student explains the mechanism of the precipitation reaction

Key competences

- communication in foreign languages;
- digital competence;
- learning to learn.

Criteria for success
The student will learn:

- to predict whether or not a sparingly soluble compound will form as a result of mixing solutions of substances being dissociated;
- to explain what the precipitation reaction (precipitation) is;
- to depict the precipitation equation equations using molecular, ionic and abbreviated ion.

Methods/techniques

- **activating**
    - discussion.
- **expository**
    - talk.
- **programmed**

    - with computer;
    - with e-textbook.
- **practical**
    - exercices concerned.
- **exposing**
    - exposition.

Forms of work

- individual activity;
- activity in pairs;
- activity in groups;
- collective activity.

Teaching aids

- e-textbook;
- notebook and crayons/felt-tip pens;
- interactive whiteboard, tablets/computers.

Lesson plan overview

Introduction

1. The teacher hands out Methodology Guide or green, yellow and red sheets of paper to the students to be used during the work based on a traffic light technique. He presents the aims of the lesson in the student's language on a multimedia presentation and discusses the criteria of success (aims of the lesson and success criteria can be send to students via e-mail or posted on Facebook, so that students will be able to manage their portfolio).
2. The teacher together with the students determines the topic – based on the previously presented lesson aims – and then writes it on the interactive whiteboard/blackboard. Students write the topic in the notebook.

Realization

1. The teacher gives students work cards. He informs them that in a moment they will watch the film from the experiment described in the abstract „Comparison of the course of reaction of sodium chloride with potassium nitrate and silver nitrate". Before this happens, they should formulate a research question and hypothesis and write them down in the work sheets. After the film's release, the teacher and the students summarize the observations - the students write them in the work sheets. The lecturer writes the equations of reactions on the board in the form of molecular, ionic and shortened ion, and at the same time explains the mechanism of this reaction. Students rewrite equations to work cards. For the consolidation of the message, the teacher

displays on the multimedia table the full and abbreviated form of the equation. He asks for the conclusion of the application resulting from this experience, which also students write in the work sheets. Note: the pupils can also follow the instructions in the abstract. The film can then be treated as a summary and comparison of the results of the experiment.

2. The teacher divides the students into groups. He gives instructions to Experiment 2 in abstract - „Can other substances than salts" take part in the precipitation reactions - and glass, equipment and reagents. Teams carry out the experience, write notes in the work sheets and talk about them on the class forum. The lecturer asks eager students to write equations of chemical reactions on the board - the others record them in the work sheets. Based on the record of reaction equations, the teacher asks students about the conclusions from this experience, which after being determined are also recorded in the work sheets.
3. In order to consolidate the message, the teacher asks students (working in pairs) to do interactive exercises in the abstract.

Summary

1. The teacher asks the students to finish the following sentences:
    - Today I learned ...
    - I understood that ...
    - It surprised me ...
    - I found out ...

    The teacher can use the interactive whiteboard in the abstract or instruct students to work with it

Homework

1. Listen to the abstract recording at home. Pay attention to pronunciation, accent and intonation. Learn to pronounce the words learned during the lesson.
2. Make at home a note from the lesson using the sketchnoting method.

The following terms and recordings will be used during this lesson

Terms

> **precipitation reaction**
>
> Nagranie dostępne na portalu epodreczniki.pl
>
> nagranie dźwiękowe słówka
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> **reakcja strąceniowa** – reakcja chemiczna zachodząca w roztworze wodnym między jonami pochodzącymi od zmieszanych ze sobą substancji, prowadząca do powstania trudno rozpuszczalnego związku, który wytrąca się z roztworu w postaci osadu

Texts and recordings

Nagranie dostępne na portalu epodreczniki.pl

Nagranie dźwiękowe abstraktu

Precipitation of sediment pt 1

A reaction in which a sparingly soluble compound is formed after mixing together the solutions of two soluble substances is called a precipitation reaction. Its essential element is the reaction between some ions formed from dissociation of the substances mixed together.

We can present a precipitation reaction in various ways. It will be discussed using the example of the reaction taking place in experiment 1. As you remember, as a result of the reaction of silver nitrate with sodium chloride, silver(I) chloride was precipitated in the form of sediment. This transformation can be described with a chemical equation in molecular form, i.e. containing molecular formulas of compounds:

$$\mathrm{AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3}$$
$$\mathrm{silver(I)\ nitrate + sodium\ chloride \rightarrow silver(I)\ chloride + sodium\ nitrate}$$

You remember that the above reaction takes place in an aqueous solution, and the substrates used for the experiment are soluble in water and occur in it in the form of ions. Two of them joined together to form a chemical compound that is sparingly soluble in water. In the equation, we can include the form in which substances occur during the reaction:

$$\mathrm{Ag^+ + NO_3^- + Na^+ + Cl^- \rightarrow AgCl + NO_3^- + Na^+}$$

You already know that this way of expressing a chemical equation, which includes the formulas of all ions present in the reaction mixture, is called a complete ionic equation. In a chemical equation presented in this way, we do not use arrows that symbolize the formation of sediment, because the method of writing (molecular formula for salt) already informs about the formation of a product that is sparingly soluble (no free ions).

Note that there are identical ions on the sides of both substrates and products, and that the presented reaction happens only between two types of ions: silver cation and chloride anion. In the complete ionic equation, we can cross out recurring ions on both sides of it:

We can therefore write down an equation that contains only symbols of ions that react with each other:

$$Ag^+ + Cl^- \rightarrow AgCl$$

This is a net ionic equation.

After mixing the two solutions, copper(II) cations and hydroxide anions formed the sparingly water-soluble copper(II) hydroxide:

$$CuSO_4 + 2NaOH \rightarrow Cu(OH)_2\downarrow + Na_2SO_4$$
$$\text{copper(II) sulfate} + \text{sodium hydroxide} \rightarrow \text{copper(II) hydroxide} + \text{sodium sulfate}$$

The above reaction takes place between ions, so it can be described with the following complete ionic equation:

$$Cu^{2+} + SO_4^{2-} + 2Na^+ + 2OH^- \rightarrow Cu(OH)_2 + SO_4^{2-} + 2Na^+$$

The net ionic equation for this reaction is as follows:

$$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$$

- Salts can react with other salts and hydroxides in an aqueous solution, provided that this reaction produces sparingly soluble products.
- If there is a reaction between two salts, the sparingly soluble product is also a salt.