



Nitrogen

- [Nitrogen](#)
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- [Lesson plan \(English\)](#)



[Link to the lesson](#)

Before you start you should know

- what the symbols of chemical elements are and how to use them;
- what an atom is and how it is built;
- what is the relation between the structure of the atom and its place in the periodic table.

You will learn

- indicate the place of nitrogen in the periodic table;
- give examples of the use of nitrogen in everyday life;
- discuss the nitrogen cycle in nature;
- describe the properties of nitrogen;
- give examples of the use of nitrogen.

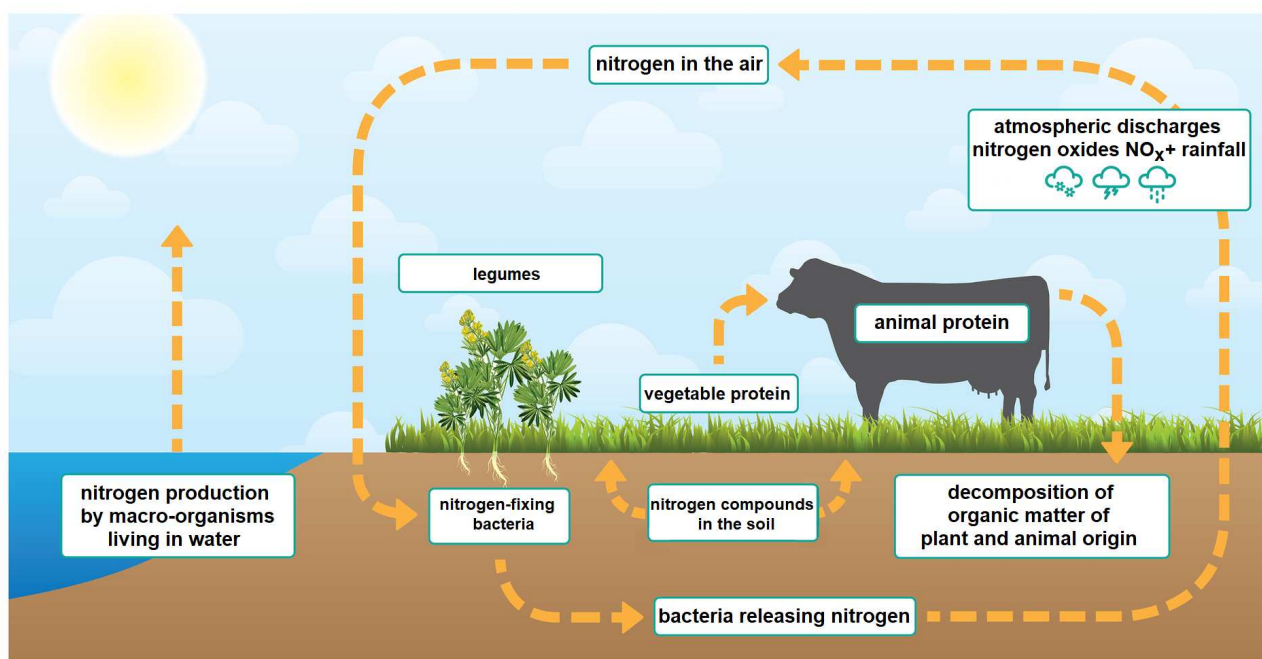
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Nagranie dźwiękowe abstraktu.

Nitrogen – occurrence and cycle in nature

Nitrogen ranks fifth in terms of prevalence in the universe. It represents 78% of the air volume in the Earth's atmosphere. Together with oxygen, it forms a mixture that we breathe.

Nitrogen is one of the most important elements. It is, among others, a part of many chemical compounds building living organisms (e.g. proteins). It also plays an important role in the growth of plants – it determines their proper development, stimulates their growth and gives them an intense green color. It also regulates the intake of other nutrients, which affects the yield quality and quantity. Only some plants, called legumes (e.g. peas, beans, peanuts), have the ability to take nitrogen from the air and use it to create plant cell building substances using the bacteria present in their roots. Nitrogen compounds can be introduced into the soil in the form of artificial fertilizers, from where they are taken up by the plants together with the water. The cyclical process of absorbing, transforming and releasing nitrogen and its compounds is called the nitrogen cycle in nature.



The circulation of nitrogen in the nature

Source: GroMar Sp. z o.o., licencja: CC BY-SA 3.0.

The presence of some plants makes it possible to assess whether the soil is rich or poor in nitrogen. For example, the massive presence of horsetail, sorrel or buttercup in the studied area indicates a low nitrogen content in the soil. As the area is fertilized with nitrogen fertilizer, these plants will start to die, and nettle, couch grass or white dead nettle will start to grow there.

Nitrogen properties

Task 1

Determine the place of nitrogen in the periodic table (group number and period number) and give the number of electron shells and the number of valence electrons in the element's atom.

Task 2

Do the experiment. Take note of what properties of nitrogen can be indicated basing on the experiments performed. Write down your conclusions.

Experiment 1

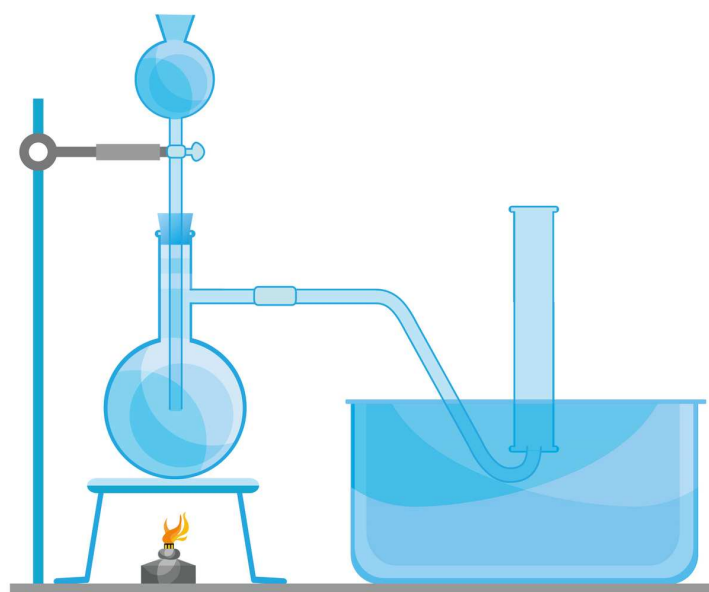
You will need

- support stand
- round-bottom flask
- dropping funnel
- crystallizer
- cylinder
- burner
- tripod
- sodium nitrite NaNO_2 - 10g
- ammonium chloride NH_4 - 10g
- potassium dichromate(VI) solution - 1 cm^3
- water

Instruction

1. Put ammonium chloride into the flask and add the appropriate amount of water to obtain a concentrated solution.
2. Then add about 1 cm^3 of potassium dichromate(VI) solution.
3. Fill the dropping funnel with sodium nitrite solution.

4. Heat the solution in the flask to boiling point.
5. Set aside the burner and slowly add sodium nitrite.
6. Write down the equations of reactions taking place in the experiment.
7. Look at the gas product collected in the cylinder. Insert an arched flame into the gas cylinder and write down observations.



Laboratory equipment for obtaining nitrogen.
Source: GroMar Sp. z o.o., licencja: CC BY-SA 3.0.

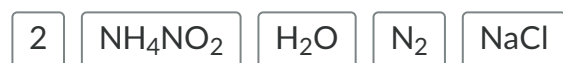
Exercise 1

Complete the reaction equations.

The reaction takes place in the flask:



The unstable ammonium nitrate decomposes with the release of free nitrogen:



Nitrogen properties

What have I observed?

What does it indicate (which properties)?

Nitrogen is non-metal and belongs to the 15th group of the periodic table. Under normal conditions (0°C, 1013.25 hPa) it is a colorless and odorless gas with a low water solubility (23 cm³N₂ in 1 liter of water in 0°C), it is present in the form of bi-atomic particles. It does not sustain combustion. It is little chemically active at room temperature.



Model, formula and structure of the nitrogen molecule

Source: Krzysztof Jaworski, licencja: CC BY 3.0.

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The use of nitrogen

Liquid nitrogen is used as a cooling agent – for freezing of biological material, e.g. samples, blood, tissues, heart valves, and during rehabilitation procedures – for local anesthetization. It is also used in cardiac surgery and blood transfusion.

Gaseous nitrogen is used as a protective atmosphere in food and pharmaceutical packaging. Compressed nitrogen is used for spraying liquids, e.g. in deodorants. In the form of chemical compounds (e.g. ammonia, nitric oxides), it is used in the manufacture of fertilizers and explosives.

Moreover, nitrogen is a component of mixtures filling, among others, diving bottles.

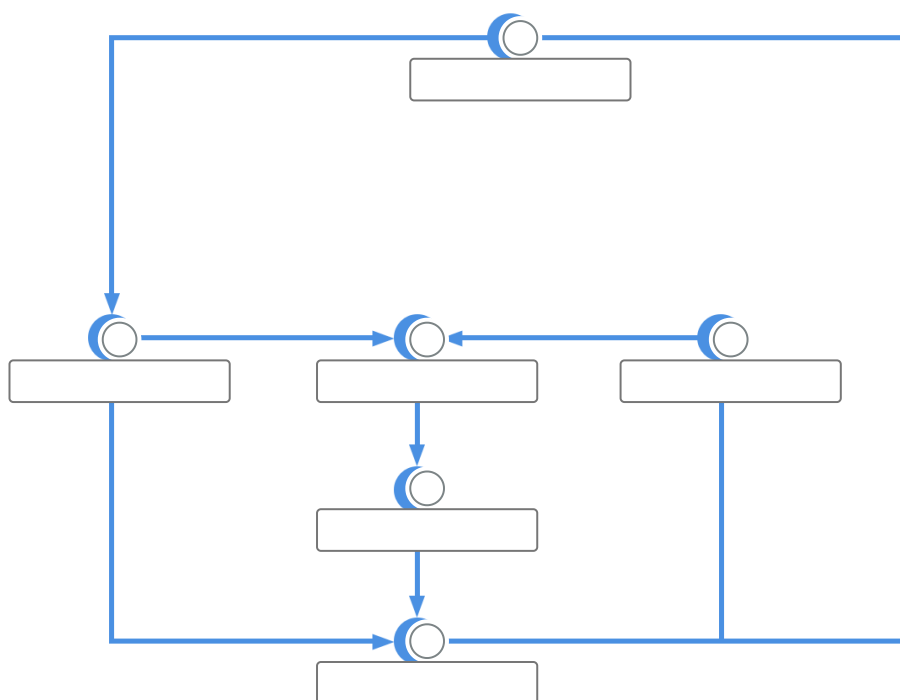
Exercise 2

Mark statements that are true.

- ☐ Nitrogen belongs to the 15th group of the periodic table.
- ☐ Compressed nitrogen is used for spraying liquids, e.g. in deodorants.
- ☐ Nitrogen is important for plants: it ensures their proper development, stimulates growth and gives them an intense green color.
- ☐ Nitrogen represents 78% of the air volume in the Earth's atmosphere.
- ☐ Nitrogen is chemically active at room temperature.
- ☐ Nitrogen is non-metal – odorless, blue gas.

Exercise 3

Complete the diagram so that it shows the nitrogen cycle in nature.



nitrogen-fixing bacteria, decomposition

nitrogen compounds in soil

protein of animal origin (e.g. feces)

free nitrogen in ambient air

legumes

decomposition

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Conclusion

- The main air components are nitrogen (78%), oxygen (21%), argon and other noble gases.
- Nitrogen is a chemical element of atomic number 7, belonging to the 15th group of the periodic table (nitrate group), has five valence electrons.
- Nitrogen is used in many industries and medicine.

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Keywords

nitrogen, liquid nitrogen, air

Glossary

nitrogen

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nagranie dźwiękowe słówka

azot – zajmuje piąte miejsce pod względem rozpowszechnienia we wszechświecie. Stanowi 78% objętości powietrza w atmosferze Ziemi. Wraz z tlenem tworzy mieszaninę, którą oddychamy.

Lesson plan (Polish)

Temat: Azot

Adresat

Uczeń szkoły podstawowej (klasy 7. i 8.)

Podstawa programowa:

Szkoła podstawowa. Chemia.

IV. Tlen, wodór i ich związki chemiczne. Powietrze. Uczeń:

8) projektuje i przeprowadza doświadczenie potwierdzające, że powietrze jest mieszaniną; opisuje skład i właściwości powietrza;

Ogólny cel kształcenia

Uczeń wyjaśnia, na czym polega reakcja spalania

Kompetencje kluczowe

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

Kryteria sukcesu

Uczeń nauczy się:

- wskazywać położenie azotu i gazów szlachetnych w układzie okresowym pierwiastków;
- wymieniać pierwiastki zaliczane do grupy gazów szlachetnych;
- podawać przykłady zastosowania azotu w życiu codziennym;
- omawiać obieg azotu w przyrodzie;
- opisywać właściwości azotu;
- podawać przykłady zastosowania azotu w najbliższym otoczeniu.

Metody/techniki kształcenia

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

- z użyciem komputera;
- z użyciem e-podręcznika.
- **praktyczne**
 - ćwiczeń przedmiotowych;
 - eksperyment.

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.
3. BHP – przed przystąpieniem do eksperymentów uczniowie zapoznają się z kartami charakterystyk substancji, które będą używane na lekcji. Nauczyciel wskazuje na konieczność zachowania ostrożności w pracy z nimi.

Faza realizacyjna

1. Nauczyciel przedstawia podopiecznym ogólne wiadomości o azocie i gazach szlachetnych. Przypomina ich położenie w układzie okresowym: chętni uczniowie podchodzą do tablicy z układem okresowym pierwiastków i omawiają poszczególne gazy.
2. Prowadzący lekcję wyświetla na tablicy multimedialnej schemat z abstraktu „Obieg azotu w przyrodzie” i omawia go.

3. Nauczyciel poleca uczniom, żeby zapoznali się z instrukcją eksperymentu zamieszczoną w abstrakcie. Po przeprowadzaniu eksperymentu uczniowie powinni odnotować swoje obserwacje w formularzu oraz wskazać właściwości azotu, a następnie omówić je na forum klasy.
4. Prowadzący lekcję dzieli uczniów na grupy. Tłumaczy zasady techniki 525 (opis w komentarzu metodycznym) i prosi o opracowanie zagadnienia „Jakie zastosowania wynikają z właściwości azotu i gazów szlachetnych” na arkuszach papieru. Uczniowie mogą korzystać z różnych źródeł informacji (abstraktu, podręcznika książkowego, internetu). Po zakończeniu prac liderzy grup przedstawiają efekty działań z zastosowaniem techniki gadająca ściana.
5. Nauczyciel prosi uczniów o samodzielne wykonanie ćwiczeń interaktywnych zawartych 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

2. Wskazany przez nauczyciela uczeń podsumowuje lekcję, opowiadając, czego się nauczył i jakie umiejętności ćwiczył.

Praca domowa

1. Odsłuchaj w domu nagrania abstraktu. Zwróć uwagę na wymowę, akcent i intonację. Naucz się prawidłowo wymawiać poznane na lekcji słowa.

Komentarz metodyczny:

Technika 525

5 – oznacz liczbę osób lub grup

2 – oznacza liczbę rozwiązań, pomysłów

5 – oznacza liczbę zmian (rundek)

Sposób przygotowania:

1. Nauczyciel zapisuje na tablicy problem, który należy rozwiązać. Uczniowie przepisują go na arkusze papieru.

2. Nauczyciel dzieli klasę na 5 grup.

3. Wyjaśnia zasady pracy i rozdaje arkusze grupom. Każda grupa wpisuje na arkusz po 2 propozycje rozwiązania problemu. Nie należy powtarzać pomysłów kolegów ani swoich, ale można je modyfikować. Po zapisaniu 2 propozycji każda grupa przekazuje arkusz sąsiedniej grupie zgodnie z ruchem wskazówek zegara. Nauczyciel ustala moment przekazania formularzy.

4. Po zakończeniu pracy grupy dokonują oceny propozycji zapisanych na arkuszach z zastosowaniem techniki gadająca ściana.

Technikę 525 można modyfikować na różne sposoby (352, 423, 635) w zależności od liczby uczniów i ich możliwości.

Technikę tę można zastosować tak, że w grupach 5-osobowych każdy uczeń otrzymuje arkusz papieru i zapisuje na nim 2 pomysły, a na umówiony znak nauczyciela przekazuje formularz sąsiadowi z lewej strony, a odbiera zaś inny arkusz od sąsiada z prawej strony. Wpisuje kolejne 2 pomysły. Formularze papieru krążą aż do wyczerpania pomysłów.

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

Pojęcia

nitrogen

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nagranie dźwiękowe słówka

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Teksty i nagrania

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Nagranie dźwiękowe abstraktu.

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breathe.

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The presence of some plants makes it possible to assess whether the soil is rich or poor in nitrogen. For example, the massive presence of horsetail, sorrel or buttercup in the studied area indicates a low nitrogen content in the soil. As the area is fertilized with nitrogen fertilizer, these plants will start to die, and nettle, couch grass or white dead nettle will start to grow there.

Nitrogen is non-metal and belongs to the 15th group of the periodic table. Under normal conditions (0°C, 1013.25 hPa) it is a colorless and odorless gas with a low water solubility (23 cm³N₂ in 1 liter of water in 0°C), it is present in the form of bi-atomic particles. It does not sustain combustion. It is little chemically active at room temperature.

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Liquid nitrogen is used as a cooling agent – for freezing of biological material, e.g. samples, blood, tissues, heart valves, and during rehabilitation procedures – for local anesthetization. It is also used in cardiac surgery and blood transfusion.

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- The main air components are nitrogen (78%), oxygen (21%), argon and other noble gases.
- Nitrogen is a chemical element of atomic number 7, belonging to the 15th group of the periodic table (nitrate group), has five valence electrons.

- Nitrogen is used in many industries and medicine.

Lesson plan (English)

Topic: Nitrogen

Target group

Elementary school student (grades 7. and 8.)

Core curriculum

Primary school. Chemistry.

IV. Oxygen, hydrogen and their chemical compounds. Air. Pupil:

8) designs and conducts experiments confirming that the air is a mixture; describes the composition and properties of air;

General aim of education

The student explains what the combustion reaction is

Key competences

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

Criteria for success

The student will learn:

- to indicate the location of nitrogen and noble gases in the periodic table of elements;
- to list elements included in the group of noble gases;
- to give examples of the use of nitrogen in everyday life;
- to discuss the nitrogen cycle in nature;
- to describe the properties of nitrogen;
- to give examples of nitrogen application in the immediate environment.

Methods/techniques

- **expository**
 - talk.
- **activating**
 - discussion.
- **programmed**
 - with computer;

- with e-textbook.
- **practical**
 - exercises concerned;
 - experiment.

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.
3. Health and safety – before starting the experiments, students familiarise themselves with the safety data sheets of the substances that will be used during the lesson. The teacher points out the need to be careful when working with them.

Realization

1. The teacher presents the pupils with general information about nitrogen and noble gases. It resembles their location in the periodic table: eager students approach the array with the periodic table of elements and discuss individual gases.
2. The teacher displays on the multimedia board a diagram from the abstract „The circulation of nitrogen in the nature” and discusses it.
3. The teacher instructs students to familiarize themselves with the experiment's instructions in the abstract. After the experiment, students should note their

observations on the form and indicate the properties of nitrogen, and then discuss them in the class forum.

4. The instructor divides the students into groups. He explains the principles of technology 525 (description in a methodical commentary) and asks for the development of the „What applications result from the properties of nitrogen and noble gases” on paper sheets. Students can use various sources of information (abstract, textbook, internet). After completing the work, group leaders present the effects of actions using the talking wall technique.
5. The teacher asks students to independently perform interactive exercises contained 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

2. The student indicated by the teacher sums up the lesson, telling what he has learned and what skills he/she has been practicing.

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.

Methodical comment

Technique 525

5 - the number of people or groups

2 - means the number of solutions and ideas

5 - the number of rounds

Preparation:

1. The teacher writes on the board a problem to be solved. Students rewrite it into sheets of paper.
2. The teacher divides the class into 5 groups.

3. Explains the rules of work and distributes sheets to groups. Each group types 2 suggestions for solving the problem on the sheet. You should not repeat your friends' ideas or yours, but you can modify them. After saving 2 proposals, each group passes the sheet to the neighboring group in a clockwise direction. The teacher determines the moment of submitting the forms.

4. After completing the work, the groups evaluate the proposals on the sheets using the talking wall technique.

Technique 525 can be modified in various ways (352, 423, 635) depending on the number of students and their abilities.

This technique can be used so that in groups of 5 each student receives a sheet of paper and writes down two ideas on it, and on the agreed teacher's sign, passes the form to the neighbor on the left, and receives another sheet from the neighbor on the right. Enter another two ideas. Paper forms circulate until the ideas are exhausted.

The following terms and recordings will be used during this lesson

Terms

nitrogen

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nagranie dźwiękowe słowa

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Texts and recordings

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