What are the consequences of Earth’s axial tilt to the plane of the ecliptic?

- What are the consequences of Earth’s axial tilt to the plane of the ecliptic?
- Lesson plan (Polish)
- Lesson plan (English)

What are the consequences of Earth's axial tilt to the plane of the ecliptic?

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Link to the lesson

> **Before you start you should know**
>
> - what Earth's dimensions and shape are;
> - that Earth rotates around its own axis, which is tilted at about a 66°33' angle in relation to the plane of its orbit;
> - what the consequences of Earth's rotation are.

> **You will learn**
>
> - explain the concept of: solar year and sidereal year;
> - describe the consequences of Earth's axial tilt to the plane of the ecliptic;
> - explain what a tellurium is and how it works.

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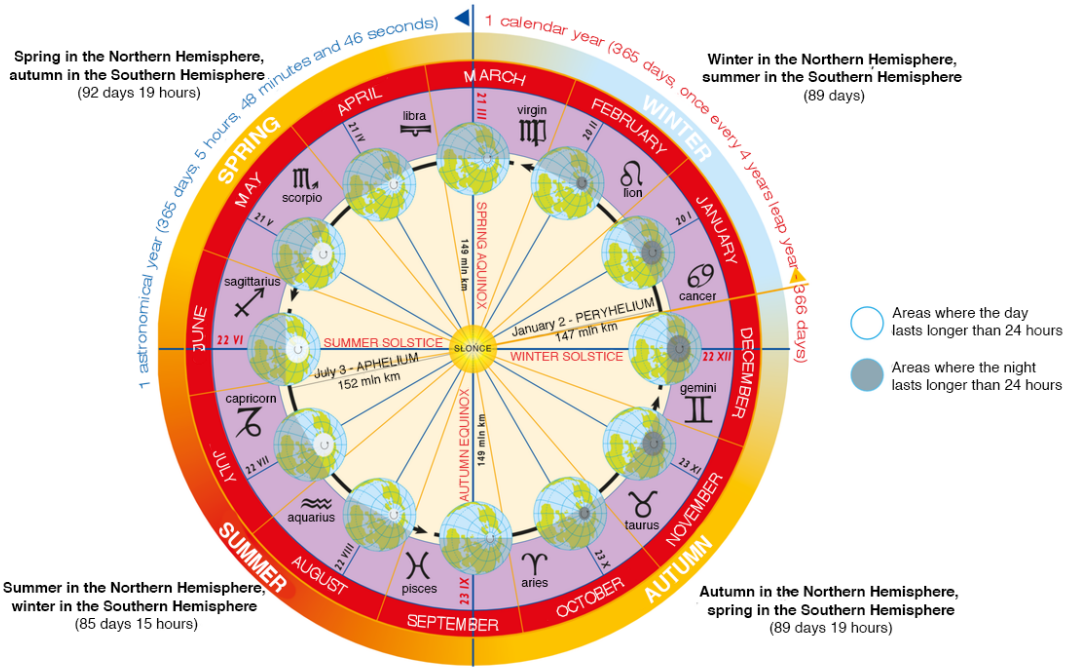
nagranie abstraktu

The Earth orbits the Sun on a slightly elongated elliptical orbit similar to a circle. This movement is called Earth's revolution. The movement of the Earth around the Sun takes place in a counter-clockwise direction (looking at the Earth-Sun system from the Northern Hemisphere).
The circulation time is slightly different in subsequent years, so we can only give a approximate time. It is commonly said that the solar year lasts 365 days 5 hours and 49 minutes. This means that, after this time, Earth returns to its starting position relative to the Sun. A sidereal year is a bit longer, it lasts about 365 days 6 hours 9 minutes and around 9 seconds. After this time has passed, Earth returns to the place from which the Sun is visible in the same position in relation to distant stars. Note that none of these measures of time has

an equal number of days, which has consequences in determining when a year actually passes, and when constructing the calendar.

You now know that Earth's axial tilt in relation to its circulation plane around the Sun is around 66°33'. Astronomers talk about the tilting of the axis to the ecliptic plane, i.e. the plane containing the orbit, on which the Earth orbits the Sun. What is extremely important for the Earth is the fact that the tilting of its axis in relation to the plane of the orbit does not change during the entire cycle around the Sun, that is, during one year. This means that for a part of the year, the axis is directed towards the Sun with its northern end, which makes the Northern Hemisphere more illuminated. For the second half of the year, the Earth's axis is directed towards the Sun with its southern end, which causes the Southern Hemisphere to be more illuminated. On the other hand, twice a year, the Earth's axis sets itself in relation to the Sun, so that both Hemispheres are illuminated identically.

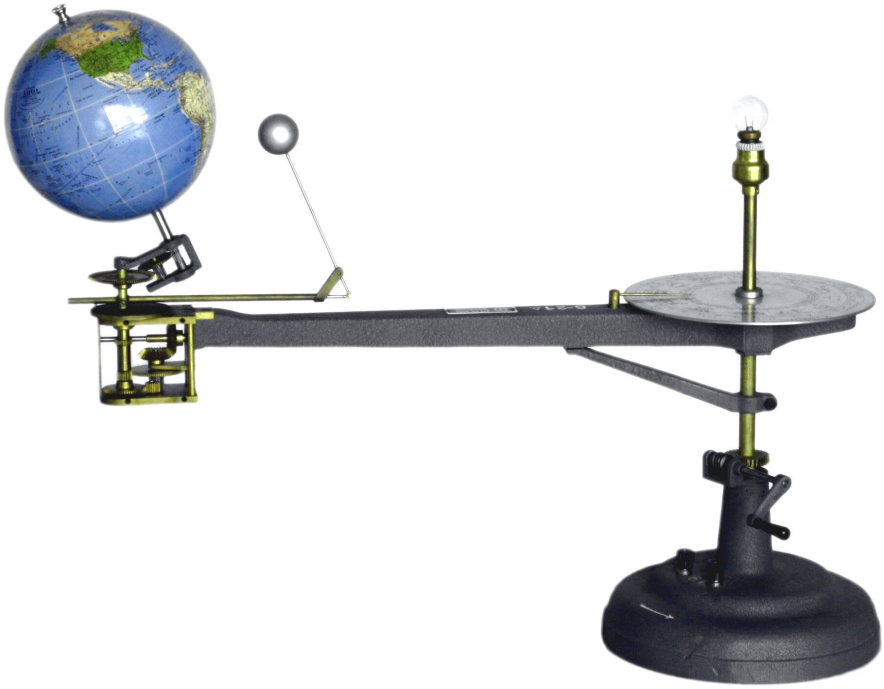


The Earth's movement carried out in orbit around the Sun during the year. The Earth's circular motion makes the Sun appear against other constellations

Source: Roman Nowacki, Krzysztof Jaworski, Wikimedia Commons, licencja: CC BY 3.0.

Task 1

Using the globe and any object playing the role of the Sun, reconstruct Earth's annual journey.



Tellurium is a model that allows the presentation of the mutual movement of the Earth and the Moon relative to each other and to the Sun. It is used to show the illumination of the Earth at various times both day and year, phases of the Moon and solar and lunar eclipses

Task 2

Set the tellurium into motion and follow the annual circulation of the Earth and Moon around the Sun. Note that the movement of the Earth around its own axis, the movement of the Moon around the Earth and the movement of the Earth (including the Moon) around the Sun occur simultaneously. Note the results in the table:

the annual circulation of the Earth and Moon around the Sun.

Exercise 1

Exercise 2

Match the definition to each of the concepts below

time between two consecutive solar passages against the same stars, the plane containing the orbit on which Earth circles around the Sun., time between two consecutive solar passages during the March equinox

sidereal year	
solar year	
the plane of the ecliptic	

Exercise 3

Which of the following phenomena would we could not observe if the Earth's equator was positioned exactly in the ecliptic plane? Select three phenomena.

- The changing of seasons
- The succession of day and night
- The changes in sunrise and sunset position
- The change in the Sun’s height above the horizon at its highest point

Exercise 4

Which of the following phenomena would be a consequence of the circular motion if the Earth's axis was set at a 90-degree angle to the ecliptic plane? Select the correct answer.

- The changing of seasons
- The change in the Sun’s position against the constellations during the year
- The change in the Sun’s height above the horizon during the day
- The changes in the length of day and night

Summary

- The tilting of the Earth's axis is fundamental for the length of day and night, the altitude of the solar noon and the changing of seasons.

- During the year, the equinox occurs twice on Earth, while the June solstice and the December solstice occur only once.
- The places of sunrise and sunset as well as the altitude of the solar noon change throughout the year depending on the latitude.

Keywords

solar year, sidereal year, ecliptic plane

Glossary

ecliptic plane

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Nagranie słówka: ecliptic plane

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płaszczyzna ekliptyki – płaszczyzna zawierająca orbitę, po której Ziemia obiega Słońce

sidereal year

Nagranie dostępne na portalu epodreczniki.pl

Nagranie słówka: sidereal year

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rok gwiazdowy – to czas pomiędzy dwoma kolejnymi przejściami Słońca na tle tych samych gwiazd; trwa 365 dni 6 godzin 9 minut i 9,54 sekundy

solar year

Nagranie dostępne na portalu epodreczniki.pl

Nagranie słówka: solar year

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rok słoneczny – to czas pomiędzy dwoma kolejnymi przejściami Słońca przez punkt równonocy wiosennej; trwa 365 dni 5 godzin 49 minut

Lesson plan (Polish)

Temat: Jakie są konsekwencje stałego nachylenia osi Ziemi do płaszczyzny ekliptyki?

Adresat

Uczeń klasy VI szkoły podstawowej

Podstawa programowa

I. Wiedza geograficzna.

1. Opanowanie podstawowego słownictwa geograficznego w celu opisywania oraz wyjaśniania występujących w środowisku geograficznym zjawisk i zachodzących w nim procesów.

II. Umiejętności i stosowanie wiedzy w praktyce.

2. Korzystanie z planów, map, fotografii, rysunków, wykresów, diagramów, danych statystycznych, tekstów źródłowych oraz technologii informacyjno-komunikacyjnych w celu zdobywania, przetwarzania i prezentowania informacji geograficznych.

8. Rozwijanie umiejętności percepcji przestrzeni i wyobraźni przestrzennej.

Wymagania szczegółowe

V. Ruchy Ziemi: Ziemia w Układzie Słonecznym; ruch obrotowy i obiegowy; następstwa ruchów Ziemi. Uczeń:

4) demonstruje przy użyciu modeli (np. tellurium lub globusów) ruch obiegowy Ziemi.

Cel lekcji Uczeń poznaje konsekwencje stałego nachylenia osi Ziemi do płaszczyzny ekliptyki.

Kryteria sukcesu

- wyjaśnisz pojęcia: rok słoneczny i rok gwiazdowy;
- omówisz konsekwencje stałego nachylenie osi Ziemi do płaszczyzny ekliptyki;
- wyjaśnisz, co to jest tellurium i w jaki sposób działa.

Kompetencje kluczowe

- porozumiewanie się w języku ojczystym;
- porozumiewanie się w językach obcych;
- kompetencje matematyczne;
- kompetencje informatyczne;

- umiejętność uczenia się.

Metody/formy pracy

- metody problemowe: rozmowa kierowana, dyskusja dydaktyczna;
- metody eksponujące: prezentacja;
- metody programowane: z użyciem komputera, z użyciem e-podręcznika;
- metody praktyczne: ćwiczenia przedmiotowe.

- praca indywidualna, w parach, w grupach i zbiorowa.

Środki dydaktyczne

- komputery z dostępem do internetu, ewentualnie tablety;
- zasoby multimedialne zawarte w lekcji „Jakie są konsekwencje stałego nachylenia osi Ziemi do płaszczyzny ekliptyki?" w e-podręczniku;
- globusy (kilka sztuk na klasę), tellurium;
- tablica interaktywna/tablica, pisak/kreda.

Fazy lekcji

Wstępna

1. Na zajęciach nauczyciel określa cel lekcji, informuje uczniów o jej planowanym przebiegu.
2. Prowadzący omawia ruch obiegowy Ziemi wokół Słońca, wprowadzając następujące pojęcia:

- rok słoneczny;
- rok gwiazdowy;
- nachylenie osi ziemskiej do płaszczyzny ekliptyki.

Nauczyciel wyjaśnia przy tym, że długość roku gwiazdowego ulega nieznacznym zmianom wskutek oddziaływań innych ciał niebieskich na tor ruchu Ziemi. Zmiany te są zauważalne na przestrzeni kilku lub kilkunastu lat. Niemniej nachylenie osi ziemskiej do powierzchni ekliptyki jest jednakowe w ciągu roku. Fakt stałego nachylenia osi ziemskiej ma zasadnicze znaczenie dla zmienności pór roku na Ziemi, klimatu, długości dnia i nocy oraz zmian miejsc wschodu, górowania i zachodu Słońca.

Realizacyjna

1. Następnie cała klasa pod kierunkiem nauczyciela analizuje i omawia ilustrację, na której przedstawiono ruch obiegowy Ziemi wokół Słońca, dołączoną do lekcji w e-podręczniku.
2. Nauczyciel dzieli uczniów na grupy (maksymalnie 5-6 osób w grupie). Każda grupa przy pomocy globusa i przedmiotu pełniącego rolę Słońca odtwarza roczną wędrówkę Ziemi

(polecenie 1 z lekcji w e-podręczniku).
3. Nauczyciel wyjaśnia, że roczną wędrówkę Ziemi wokół Słońca można odtworzyć przy pomocy tellurium, prezentując ilustrację dołączoną do polecenia 1. Jeśli tellurium jest na wyposażeniu pracowni – każda grupa kolejno wykonuje ćwiczenie opisane w treści polecenia 2 z lekcji w e-podręczniku.

Podsumowująca

1. Uczniowie wykonują ćwiczenia na tablicy interaktywnej.
2. Ostatnim etapem lekcji jest dyskusja na temat omówionych zagadnień i podsumowanie zajęć. W trakcie dyskusji uczniowie zadają pytania, proszą nauczyciela o wyjaśnienie wszelkich wątpliwości oraz uzupełniają notatki.

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

Pojęcia

> **ecliptic plane**
>
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>
> Nagranie słówka: ecliptic plane
>
> ---
>
> płaszczyzna ekliptyki – płaszczyzna zawierająca orbitę, po której Ziemia obiega Słońce

> **sidereal year**
>
> Nagranie dostępne na portalu epodreczniki.pl
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> Nagranie słówka: sidereal year
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>
> rok gwiazdowy – to czas pomiędzy dwoma kolejnymi przejściami Słońca na tle tych samych gwiazd; trwa 365 dni 6 godzin 9 minut i 9,54 sekundy

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> rok słoneczny – to czas pomiędzy dwoma kolejnymi przejściami Słońca przez punkt równonocy wiosennej; trwa 365 dni 5 godzin 49 minut

Teksty i nagrania

Nagranie dostępne na portalu epodreczniki.pl

nagranie abstraktu

What are the consequences of Earth's axial tilt to the plane of the ecliptic?

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- The tilting of the Earth's axis is fundamental for the length of day and night, the altitude of the solar noon and the changing of seasons.
- During the year, the equinox occurs twice on Earth, while the June solstice and the December solstice occur only once.
- The places of sunrise and sunset as well as the altitude of the solar noon change throughout the year depending on the latitude.

Lesson plan (English)

Topic: What are the consequences of the Earth's axial tilt to the plane of the ecliptic?

Target group

6th-grade student of elementary school

Core curriculum

I. Geographical knowledge.

1. Learning the basic geographical vocabulary to describe and explain the phenomena and processes that occur in the geographical environment.

II. Skills and use of knowledge in practice.

2. Using plans, maps, photographs, drawings, charts, diagrams, statistical data, source texts and information and communication technologies to collect, process and present geographic information.

8. Improving perception skills and spatial intelligence.

Detailed requirements

V. Earth movements: The Earth in the solar system; the Earth's revolution and rotation motion; consequences of the Earth's movements. The student:

4) demonstrates the Earth's revolution using models (e.g. tellurium or globes).

The general aim of education Student learn the consequences of the Earth's axial tilt to the plane of the ecliptic.

Criteria of success

- explain the concept of: solar year and sidereal year;
- describe the consequences of the Earth's axial tilt to the plane of the ecliptic;
- explain what a tellurium is and how it works.

Key competences

- communication in the mother tongue;
- communication in foreign languages;
- mathematical competences;
- digital competence;
- learning to learn.

Methods / forms of work

- the problem-solving methods: structured interview, discussion;
- the demonstrating method: presentation;
- programmed learning: via computer, e-textbook;
- practical learning: exercises on the subject.

- individual activity, activity in pairs, activity in groups, and collective activity.

Teaching aids

- computers (or tablets) with internet access;
- multimedia resources available under “What are the consequences of the Earth’s axial tilt to the plane of the ecliptic?” in the e-textbook;
- globes (few per class), tellurium;
- interactive whiteboard/blackboard, marker/chalk.

Lesson plan overview (Process)

Introduction

1. In class, the teacher defines the purpose of the lesson, informing students about its planned course.

2. The teacher discusses the revolution of the Earth around the Sun while introducing the following concepts:

- solar year;
- sidereal year;
- the Earth’s axial tilt to the plane of the ecliptic.

The teacher explains that the length of a sidereal year changes slightly due to the impact of other celestial bodies on the path of the Earth's motion. Those changes can be visible over the course of a few or several years. However, the Earth’s axial tilt to the plane of the ecliptic remains the same over the year. The fact the Earth’s axial tilt is constant is essential for the changes of the seasons on the Earth, the climate, the length of day and night, and the changes of the location of the sunrise, solar noon and sunset.

Realization

1. After that, the whole class, under the supervision of the teacher, analyses and discusses the illustration, attached under the lesson in the e-textbook, which shows the Earth’s revolution around the Sun.

2. The teacher divides the students into groups (no more than 5-6 people). Each group, using a globe and an object that plays the role of the Sun, recreates the annual movement of

the Earth (task 1 under the lesson in the e-textbook).

3. The teacher explains that the annual movement of the Earth around the Sun can be recreated using a tellurium, presenting the illustration attached to exercise1. If the school is equipped with tellurium - each group performs the task described in the content of task 2 under the lesson in the e-textbook.

Summary

1. Students carry out interactive exercises on the interactive whiteboard.

2. The last stage of the lesson is a discussion about the issues discussed and a summary of the class. During the discussion, the students ask questions, ask the teacher to clarify any doubts, and complete their notes.

The following terms and recordings will be used during this lesson

Terms

ecliptic plane

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Nagranie słówka: ecliptic plane

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płaszczyzna ekliptyki – płaszczyzna zawierająca orbitę, po której Ziemia obiega Słońce

sidereal year

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Nagranie słówka: sidereal year

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rok gwiazdowy – to czas pomiędzy dwoma kolejnymi przejściami Słońca na tle tych samych gwiazd; trwa 365 dni 6 godzin 9 minut i 9,54 sekundy

solar year

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Nagranie słówka: solar year

> rok słoneczny – to czas pomiędzy dwoma kolejnymi przejściami Słońca przez punkt równonocy wiosennej; trwa 365 dni 5 godzin 49 minut

Texts and recordings

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nagranie abstraktu

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