

Learning Tool Code	Title
SDG13-SDGfP	<b>CLIMATE CHANGE</b>
<b>Objectives</b>	
<ul style="list-style-type: none"> <li>● to highlight the factors that characterize the climate, to give students an idea of its rhythmic change in the history of our planet, to determine the natural and anthropogenic causes and consequences of these changes;</li> <li>● to characterize the climate of the Stara Zagora region, based on data from various sources, to identify the process of climate change in our region;</li> <li>● identification of possible measures for solving problems;</li> <li>● development of creativity and communication skills.</li> </ul>	
<b>Activity details</b>	
<ul style="list-style-type: none"> <li>❖ <b>Materials</b>- table "Development of life on Earth", guide - "Clock of Evolution", map of Bulgaria. Signs with the inscription "Cooling" and "Warming", cards for group work, materials for the game "Greenhouse effect".</li> <li>❖ <b>Duration</b> – 80 minutes</li> <li>❖ <b>Number of groups</b> - several groups of students (5 grade, ages 11-12)</li> </ul>	
<b>Instructions</b>	
<p><b>1. Update of knowledge.</b></p> <p>Students, we will now play the game "Yes - no":</p> <ul style="list-style-type: none"> <li>- Climate is the state of the atmosphere of a place at a certain point in time (no); / 1 minute /</li> <li>- Weather is the state of the atmosphere of a place at a certain point in time (yes); / 1 minute /</li> <li>- Climate is a geographical characteristic of an area, long-term meteorological regime (yes); / 1 minute /</li> <li>- The climate of the region is determined primarily by latitude (yes). / 1 minute /</li> </ul> <p><b>2. Putting the problem situation.</b></p> <p>We remembered that "climate" is by definition a geographical feature of an area, a long-</p>	

term meteorological regime. Does this mean that climate is a constant, unchanging characteristic? What do you know about global warming and climate change? What are the consequences of these processes? (Students present their hypotheses, citing evidence as examples). / 10 minutes /

### 3. Defining the topic of the lesson.

Today in the lesson we will recall the factors that determine the climate of the Stara Zagora region, and we will try to understand whether there is a problem with climate change in our region. To confirm our assumptions and reach common conclusions, we will work in groups (6 people)

Group 1 examines climate change and its effects on our planet's past. Group 2 will identify the natural causes of climate change.

Group 3 will show the dependence of climate change on human activity.

Group 4 will characterize the climate of the Stara Zagora region.

/ 7 minutes /

### 4. Joint discovery of knowledge and their application in practice.

Students, we begin the presentation of your group work. During the presentation we will answer your questions. Over time, the Earth's climate is slowly changing.

To understand what changes may occur in the future, we need to study the climate of the past.

*Presentation of the work of the 1st group.* Task: Using the table, note on the chronology of climate change: warming, cooling, ice ages with symbols. Make a conclusion. (Reference table example.)

№	Monthly cycle	Features of period	Climate change
1.	Devonian	The first amphibians, mosses and horsetails	Hot, dry climate
2.	Carbon (coal)	Reptiles appear. Burning from huge plauns and ferns.	Cold
3.	Permian	About half of groups alive organisms disappear. Coniferous trees appear.	The northern hemisphere getting up getting drier and colder
4.	Triassic	Reptile dominance.	Warming

		appearance of the first mammals	
5.	Jurassic	The appearance of the first birds. The dominance of dinosaurs.	Humid climate
6.	Chalk	The appearance of flowering plants. Dinosaurs and other animals are dying out.	Cold. Warming.
7.	Neogene	Mammalian development. The appearance of humanoid creatures	cold
8.	Periods of quaternary	Mammals: rhinos, mammoths. The appearance of the first people.	Cold, glacial period, constantly warming

Students place maps of climate change on the timeline. Warming is indicated by a red semicircle, cooling by a blue triangle, and the ice age by a snowflake.

*Conclusion:* in the history of our planet there have been climate changes - warming, cooling, ice ages. These changes have affected the existence of the inhabitants of our planet. (Table story with timeline demonstration). The teacher can use the Evolution Clock manual. 1 hour - 150 million years, 1 minute - 2.5 million years.

/ 10 minutes /

*Teacher's story:* Climate research began 300 years ago. Therefore, scientists are forced to look for different ways to decipher its changes.

For example: study of plant and animal fossils; examination of tree rings; Records in ship's logs, photos, etc. also help. The cooling of the Earth is observed every 100,000 years (on our clocks - every 2.5 seconds).

Many periods of Earth's history over the last 2 million years have been characterized by severe cooling and glacier formation. The last glaciation ended 10,000 years ago. We live in an interglacial era.

For example: 18,000 years ago Northern Europe, part of Siberia, Canada, the northern regions of the United States, etc. are covered with ice sheets up to 1000 m thick. The

glacier has absorbed so much water that the British Isles were connected to Europe by land (demonstration of a map of Eurasia).

Why has the climate changed on our planet? The second group will answer this question.

/ 5 minutes /

*Presentation of the work of the 2nd group.* Task: identify the natural causes of climate change, fill in the table, draw a conclusion. Italic words are written by students. (Reference table example.)

№	Reasons for cold	Notes (editing)	Reasons for warming
1.	Change of the earth orbit.		



2.	<b>Change to the slope of the earth os.</b>		



3.	<b>Volcanic eruption.</b>	1991 Eruption of Pinatubo peak (Philippines). The average temperature of the Earth is 5 degrees lower than usual.	
4.	<b>It's the sun less active.</b>	The frequency of occurrence of sunspots (11 years).	

5.	<b>Falling asteroids.</b>	Tunguska meteorite (1908)
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Insertion words: a new change in the Earth's orbit, a change in the inclination of the Earth's axis, a decrease in volcanic activity, the Sun is less active.

The keyword cards are placed on the board under the words "Cooling" and "Warming".

Conclusion: Climate change can occur without human intervention due to changes in nature. / 10 minutes /

*Presentation of the work of the 3rd group.* Task: to show the impact of human activity on climate change. Fill in the table, study the diagrams, make a conclusion. *Italic words are written by students.* (Reference table example.)

No	Reasons for warming	Greenhouse gases	Answer
1	Energy production and use		The use of renewable sources of energy.
2	Industry.	Carbon dioxide, CFCs, methane, ozone.	Use of new technologies and materials
3	Agriculture		
4	Deforestation.		Recover forests.

Placement words: energy production and use, carbon dioxide, industry, CFCs, agriculture, methane, deforestation, ozone.

On the dashboard under the word "Warming" there are maps with keywords indicating the causes of warming.

Environmental pollution is related to human activity and one side of this activity is related to their heating of people. Therefore, in order to reduce the pollution of nature from this activity, people are looking for and finding new technologies and materials for their heating. One example of this is heating with sunflower husk pellets. The energy obtained from sunflower husks is very high. Recent scientific studies show that this energy can be even higher if the flakes are compressed with a high density and without moisture in their composition. This undoubtedly makes sunflower husk pellets a biofuel of the future. In

comparison, burning two kilograms of sunflower husk pellets is equivalent to burning a liter of liquid fuel.

How are sunflower husk pellets produced? The sunflower husks are poured and processed in a buffer silo with a size of 300 cubic meters, from where they go to the palletizing sector. There, the flakes are pressed into cylindrical eco pellets with an average length of 10 to 30 millimeters and a diameter of 6 to 10 millimeters. The average production of a palletizing machine is 1500 kg per hour. Sunflower husk pellets have a high index of concentrated power: 4.3-4.5 kw / kg. This figure is comparable to coal and 1.6 times higher than that of wood. During the combustion of 1000 kg of sunflower husk pellets, the amount of heat released is the same as when burning 685 liters of fuel oil / 500 liters of diesel fuel / 479 cubic meters of natural gas or 1600 kg of wood; Pellets are safe and environmentally friendly fuels. When burned, the amount of CO<sub>2</sub> released into the air is the same as during the natural decomposition of the biomass used to create them;

Conclusion: Human activity has a significant impact on climate change.

/ 10 minutes /

*Presentation of the work of the 4th group. Task: to characterize the climate of the Stara Zagora region. Connect the beginning and end of the phrase with lines.*

1 Average winter temperature From +2 degrees.

2 Summer rains. 650 mm.

3 Average temperature in summer. +27 to +42 degrees

The students invent a story about the climate of our region.

Conclusion: Stara Zagora is located in a transitional continental area with influence from the Mediterranean Sea. In winter, the weather is milder and warmer than the cities in the Thracian lowlands, as Sredna Gora protects from the cold northern and northeastern winds.

/ 10 minutes /

Summary of the lesson. According to various studies from the middle of the 19th century, the average annual temperature began to rise. An increase in temperature was also noted in Stara Zagora. Our planet is about to enter the next ice age. Maybe this will happen in



the next millennium. However, due to the greenhouse effect, warming is observed. What does our planet and our earth expect in the future?

/ 3 minutes /

Setting homework assignments. Students are divided into groups:

1st group - environmentalists, will determine the possible consequences of warming;

2nd group - geographers, will reveal the peculiarities of the geographical location of our region;

3rd group - economists, will talk about the development of the Stara Zagora region;

4th group - physicists - inventors of new technologies.

Each group receives an extended task (search and analysis of information, drawing conclusions). The teacher coordinates the work of the children, the students prepare for the presentation - the defense of their projects.

/ 5 minutes /

### Tips for the facilitator

According to various studies from the middle of the 19th century, the average annual temperature began to rise. An increase in temperature was also noted in Stara Zagora.

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### Debriefing

Setting homework assignments. Students are divided into groups:

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### Follow-up/Inspiration for the future

Information on social media, school website.

## References/Further reading

<https://www.youtube.com/watch?v=LxgMdjyw8uw>

## Annex

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2.	<b>Change to the slope of the earth os.</b>		New change in slope on the earth's axis.
3.	<b>Volcanic eruption.</b>	1991 Eruption of Pinatubo peak (Philippines). The average temperature of the Earth is 5 degrees lower than usual.	Reduced volcanic activity.
4.	<b>It's the sun less active.</b>	The frequency of occurrence of sunspots (11 years).	The sun is active.
5.	<b>Falling asteroids.</b>	Tunguska meteorite (1908)	

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