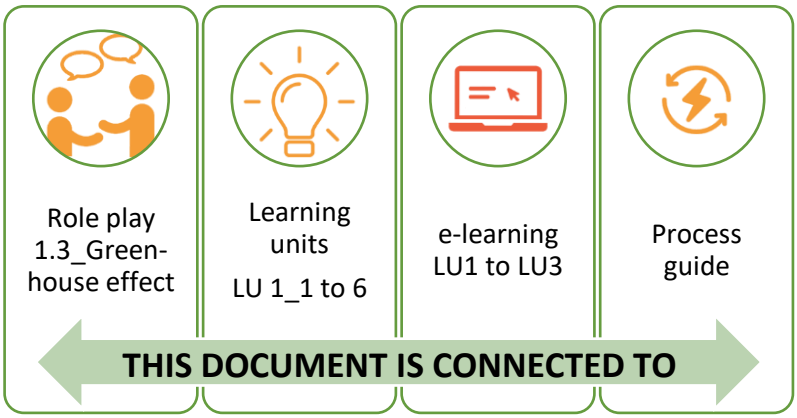
Our Solar Town

Learning Unit 1.3

Basic information on climate change and global warming



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VSE

Κέντρο Περιβαλλοντικής Εκπαίδευσης Πέρτουλίου - Τρικκαίων

Solar Heat Europe
ESTIF

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Climate Alliance Austria

Learning Unit 1.3 - Learning Plan

Basic information on climate change and global warming

Climate changes are constant and natural phenomenon throughout Earth's geological time. In the last million years the average annual and seasonal atmosphere temperature changed several times, due to the movement of lithospheric plates (e.g., earthquakes, tsunamis, volcanic activity), variations in the Earth's orbit and alternation in the sun's energy output (solar radiation), which also creates perturbations of the water cycle. Every sudden temperature change during ecological time resulted in the extinction of numerous plant and animal species (e.g., dinosaurs).

Recent data shows a rapid increase of the average air temperatures in the last century. Global warming is occurring more rapidly than in the past and therefore provokes extreme events, such as ice melting at Earth's poles, permafrost and mountain glaciers, severe weather phenomena (hurricanes, heatwaves, wildfires, droughts, and floods), deforestation, desertification and also changes in the cloud and vegetation cover. Global warming is happening so quickly that many living species are not able to adapt. Therefore, in the next decades the extinctions of several animal and plant species is predicted.

Global warming does not refer only to natural processes, but humans can also induce it. We release enormous amount of greenhouse gasses such as carbon dioxide (CO_2), water vapour (H_2O), methane (CH_4), tropospheric ozone (O_3), nitrogen (NO_x) and sulphur oxides (SO_x) by burning fossil fuels. The important role of these gasses is to transmit sunlight and to absorb certain solar energies, which, after reaching the Earth's surface, radiate back out to space. The process is similar to glass walls keeping the suns energy in a greenhouse to grow vegetables. The greenhouse gas layer is important for maintaining a suitable surface temperature for life. Otherwise, the average temperature on Earth would be around -18°C.

The modern way of life with high global energy consumption, industry demand, intensification of agriculture and raising transport needs, resulted in emitting enormous amounts of greenhouse gasses. Most of manmade emissions represent CO_2 due to the burning of fossil fuels. As CO_2 persists much longer in the atmosphere than other greenhouse gases (e.g., methane), it contributes the most to global warming. The amount of emitted CO_2 exceeds the plants accumulation and the production of it is too fast to be soaked up in natural reservoirs, such as the oceans.

Recent studies indicated that human activities are likely to be responsible for the global warming which is occurring predominantly due to CO_2 emissions. In 2005 several countries around the world adopted adverse effects of global warming and signed an international agreement named "Kyoto Protocol", to reduce the greenhouse gas concentrations in the atmosphere.

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The “Paris Agreement” was adopted on December 12, 2015 at the UN climate conference in Paris and provides for the limitation of man-made global warming to well below 2 ° C compared to pre-industrial values. All countries in the world acknowledge the Paris Agreement. The United States is the only country in the world to withdraw from the agreement.

However, some economically developed countries with enormous heavy industry production and large electricity demands are not willing to follow any significant mitigation environmental actions of neither “Kyoto Protocol” nor “Paris Agreement. The awareness of global warming should also be addressed to the individual scale. Each of us can contribute to the reduction of greenhouse gases by calculating the carbon footprint which tells us how much CO_2 is released into the atmosphere with certain activity. For example, we can calculate the amount of CO_2 gas emitted by heating with wood or photo thermal energy. An exemplary carbon footprint calculator you can find here.

Due to growing the global energy consumption and the consequences of burning fossil fuels, the manmade greenhouse gas emissions are constantly increasing and contributing to global warming. Our clock is ticking and the only way is to switch to renewable energy technologies, to provide sustainable electricity. The production of renewable energy contributes to the reduction of greenhouse gas emissions and therefore reduces global warming. Without taking actions on environmental preservation, life on Earth cannot follow these rapid climate changes.

SOURCES:

- *nationalgeographic.com*
- ***Text book: Naravoslovje 7, Geografija 8, Biologija 9***
- *umanotera.org*
- *https://www.carbonfootprint.com/calculator.aspx*

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Learning unit 1.3 – Teaching plan

Basic information on climate change and global warming

The lesson provides a fun and engaging activity for the pupils to learn about climate change and global warming through an interactive quiz.

TIME: 45 min

CLASS ORGANISATION: frontal and group work

METHODOLOGY: video respectively PowerPoint presentation

LESSON GOALS:
Topic of the project: Climate protection in general
Pupils:
- learn about the impact of carbon dioxide: greenhouse effect
- understand ecological problems caused by climate change and global warming
- learn about the consequences of the human impact on global warming
- become acquainted with the carbon footprint
- learn about international alliance agreement “Kyoto Protocol” and “Paris Agreement”
- work as a team

MATERIALS:
- computer and projector
- PowerPoint presentation of the quiz. You can download it here: https://solartown.eu/symfony/public/download/teaching/62
- A, B, C and D letter cards in blue, red, green and yellow
- Colouring sheet with the map of Europe (Worksheet 1)
- **optional white board*

INTRODUCTION/MOTIVATION (10 minutes):
First, the teacher explains the rules of the game “Cleaning Europe’s air”. The pupils are divided into 4 groups. Each group has its colour (blue, red, green and yellow) and gets a letter cards with the same colour. The quiz is guided and moderated by the teacher. The quiz is projected in a PowerPoint projection. For each question, four ~~(4)~~ answers are given. Each group needs to decide, which answer they think is the right one (A, B, C, D) in a given time (as long as the music in the presentation plays). Then they must lift the card with the letter of their chosen answer. When presented with the right answer, the groups answering correctly can select a country and colour it in (in the colour of their group). The teacher should explain the right answer in few more details, to make sure pupils learn the content.

MAIN PART (30 min)
Questions:

1. What is the term describing changes in climate, occurring from the Earth’s formation until today?

A **climate change** / B atmospheric changes / C ozone hole / D everyday changes

2. In the ice age the temperature on Earth changed due to:

A Sun’s weak radiation / B **movement of lithospheric plates** / C the Earth was spinning slower / D there is no known cause

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3. How do we call the increase of the average temperature on Earth?
The rise of air temperature / B warm period / C **global warming** / D ice age

4. A greenhouse is a place to grow vegetables, the “greenhouse effect” is then:
A **heating of the air due to greenhouse gases** / B heating of the air due to dessert enlargement / C tropical rainforest deforestation / D heating of the oceans

5. Greenhouse effect is important for maintaining a suitable surface temperature for life. Otherwise, the average temperature on Earth would be:
A **colder** / B hotter / C same as now / D with no effect

6. Most greenhouse gases, such as carbon dioxide (CO2), methane (CH4), nitrogen (NOx) and sulphur oxides (SOx), are released:
A when glaciers are melting / B when using wind turbines / C when using electricity / D **when using fossil fuels**

7. Who uses the most carbon dioxide?
A **plants and oceans (algae and phytoplankton)** / B humans and animals / C industry / D no one

8. Who produces the most carbon dioxide?
A plants / B **humans** / C animals / D no one

9. The needs for energy consumption are globally still rising, but the fossil fuels are slowly disappearing. These can be substituted with:
A **renewable energy sources (sun, wind, water)** / B waist / C we cannot replace these / D nuclear energy

10. What is the name of the international agreement encouraging the reduction of greenhouse gas concentrations to be released in the atmosphere signed by several countries worldwide in 2005?
A Europe protocol / B worldwide protocol / C **Kyoto protocol** / D NATO protocol

11. How can each one of us contribute to the reduction of greenhouse gases?
A **driving a bicycle, use of solar energy** / B driving with a car as fast as possible, to reach final destination quicker / C heating using oil / D traveling by plane

12. What does a term carbon footprint mean?
A drawing using coal / B **calculation of how much CO2 is released into the atmosphere with a certain activity** / C printing using carbon / D it has no meaning

13. Why is it getting warmer on Earth?
A less greenhouse gases in the atmosphere / B more rain / C less rain / D **more greenhouse gases**

14. What would be the average temperature on Earth without the greenhouse effect?
A - 50° C / B + 15 °C / C **– 18 °C** / D + 30 °C

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ASSESMENT (5 min)
On the map we take a closer look at which colour is the most represented after the quiz. The group with that colour wins and they have just cleaned the air in Europe using their knowledge.
To deepen the topic, the students may use the worksheet of this learning unit and compile a graphic about the effects of the greenhouse gases.

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Learning unit 1.3 – Worksheet 1

Cleaning Europe's air

LEARNING UNIT 1.3: WORKSHEET 1

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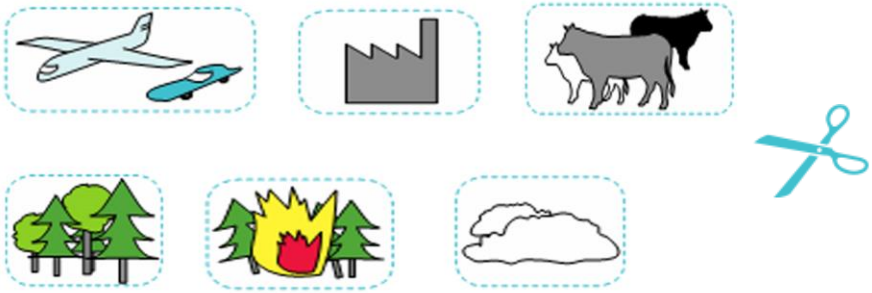
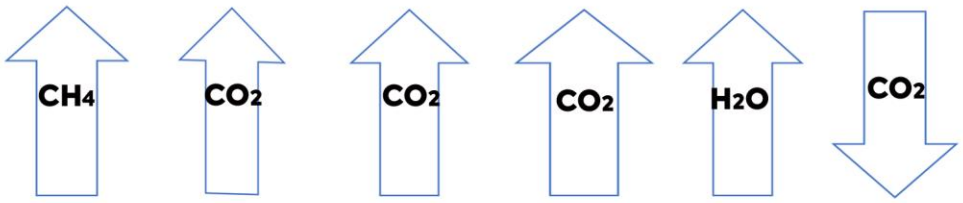
Learning unit 1.3 – Worksheet 2

Basic information on climate change and global warming

Make a chart on the effects of the greenhouse gases

1. Cut out the pictures, text boxes and arrows
2. Glue the pictures with the correct text boxes onto the globe on the next page
3. Put the arrows in the correct place, pay attention to the direction of the arrows (upwards: emission of…, downwards: absorption of…)
4. Check your results by using the solution sheet. Then glue the arrows to the graph.





Mobility and transportation

Power plants and industry

Cattle breeding

Forest

Slash and burn land clearance

Increasing evaporation of water

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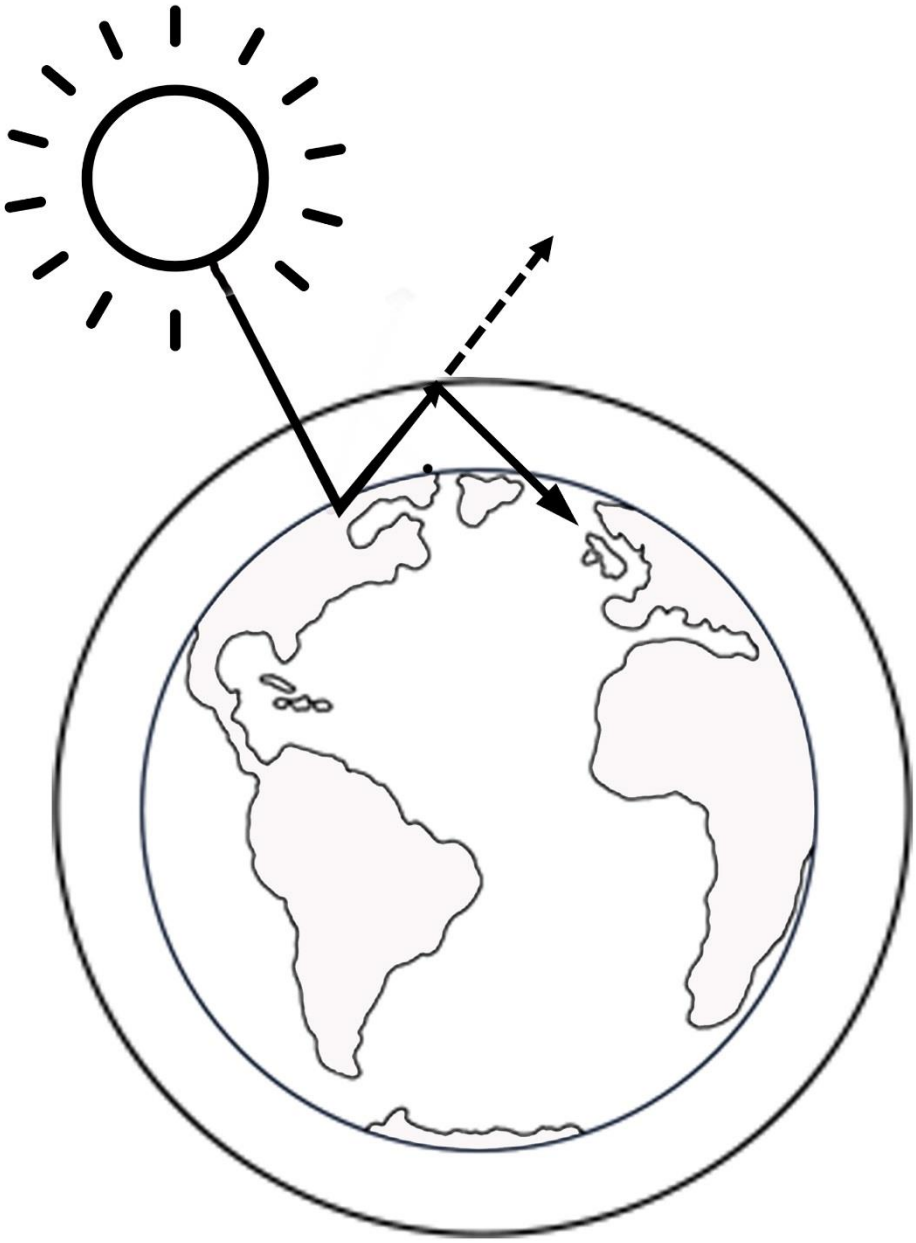
Learning unit 1.3 – Worksheet 2



LEARNING UNIT 1.3: WORKSHEET 2

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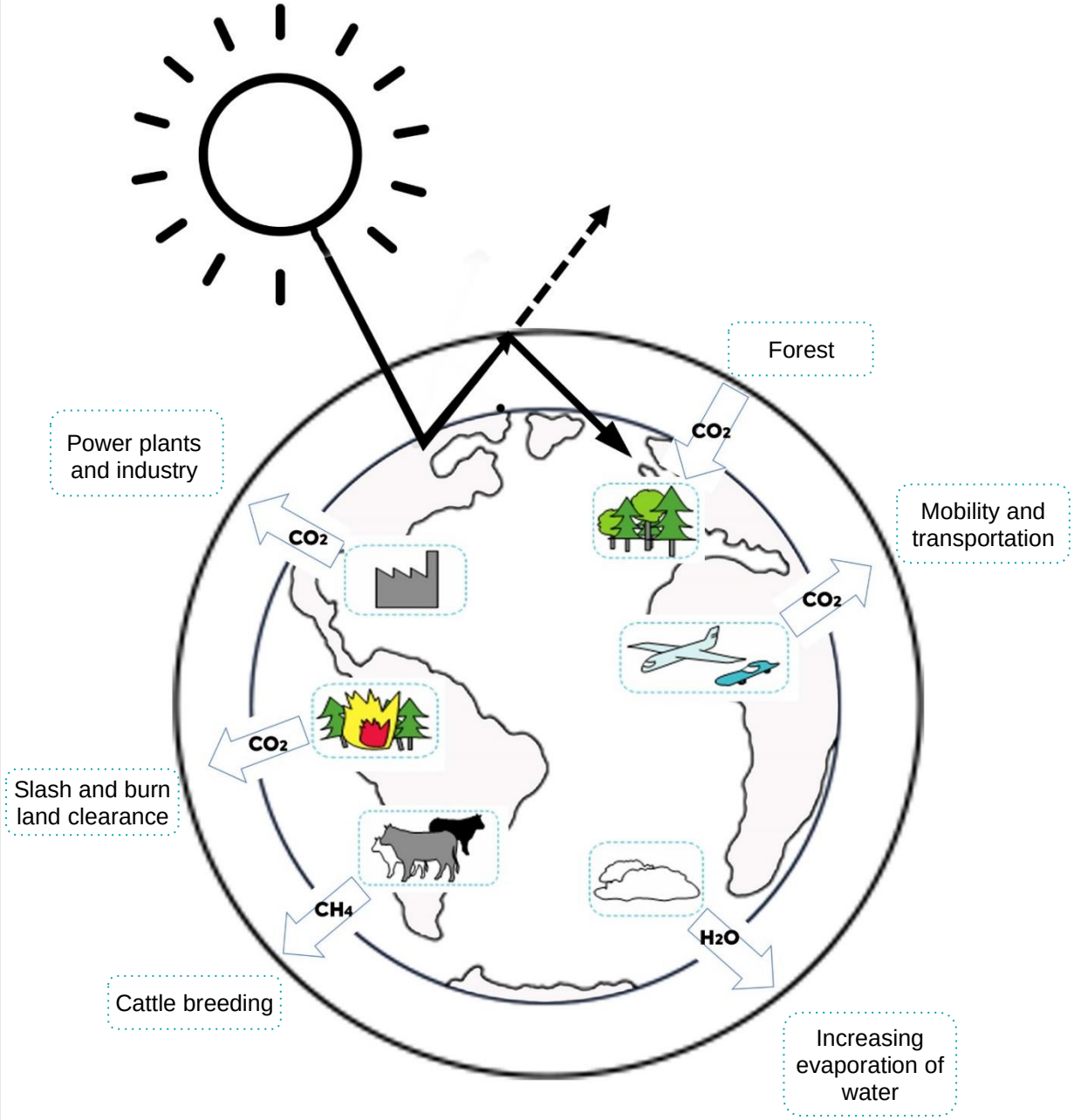
Learning unit 1.3 – Solution sheet 2

LEARNING UNIT 1.3: SOLUTION SHEET 2



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