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CLIMATE CHANGE



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1. INTRODUCTION

Debate topics

- Debate topic 1: In order to curb the effects of climate change, every person must forgo at least one flight.
- Debate topic 2: All species, not just humans, have to adapt to the effects of climate change.
- Debate topic 3: To prevent a climate catastrophe, we need to give up eating meat.

Definitions

Climate describes the weather typical of a particular region over a number of decades. This includes average air temperature, humidity, barometric pressure, wind conditions and precipitation.

Climate change is a significant variation emerging over a long period of time in the statistical indicators of climatic conditions.

Adaptation refers to increased harmony between an organism and its environment.

Climate crisis is a term which is used to describe a situation where rapid changes in the climate cause critical conditions in a number of areas of life simultaneously.

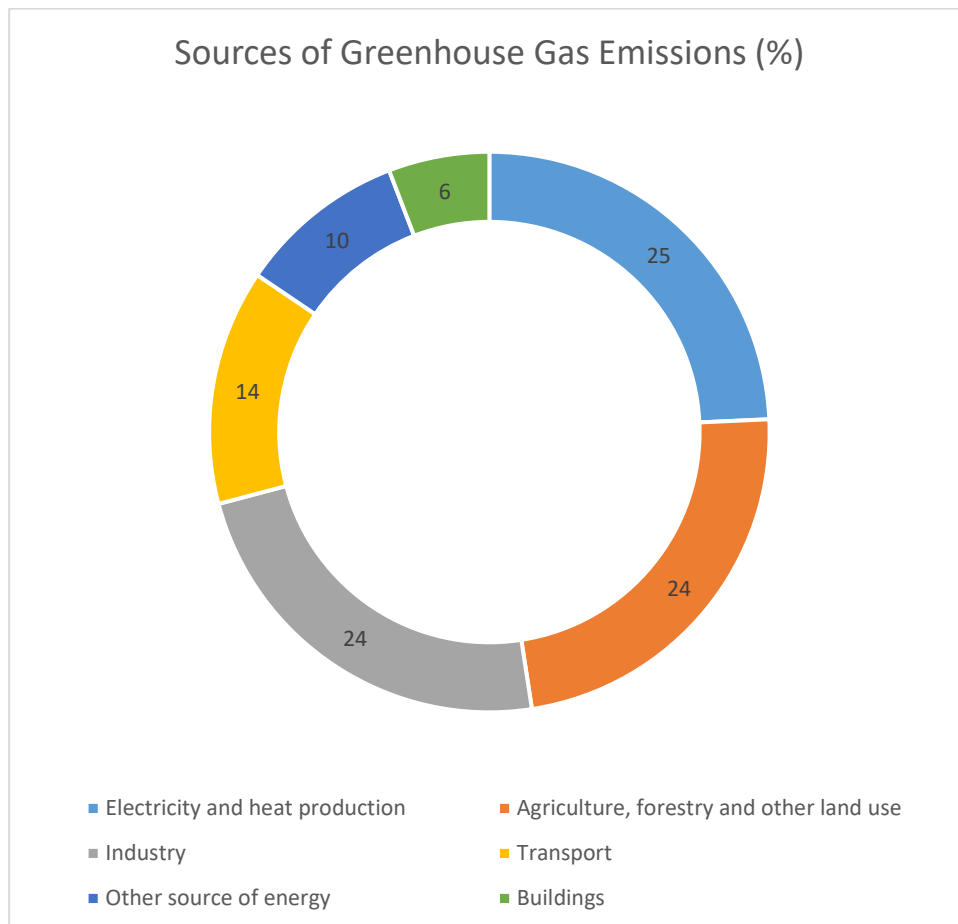
Introductory questions

1. How climate change may affect you?
2. What can you do to reduce climate change?
3. What do you think contributes most to climate change?

Take a look at the climate change video: <https://youtu.be/bkbVHVvdnC4>

2. INFORMATION CARD

2.1 Climate change



2.2 What does climate change mean?

Nowadays, when we talk about climate change, we talk about the changes in the climate that have taken place during the course of our existence as a species.

Since the industrial revolution (meaning when humans started producing a lot of energy as a result of mining and factory production, which did not exist before the turn of the 19th century), besides natural causes of changes in the climate, the human factor has added to climate change. This in turn causes unfavourable changes in the living conditions of humans and other species.

Therefore, the current change in the climate actually refers to the warming of the climate due to human activity, meaning that the average temperature is changing. As currently in various parts of the planet, global warming is causing worsening changes in weather (more rain and storms), we are talking about climate change.

2.3 Greenhouse effect

The greenhouse effect is a natural phenomenon in the climate, which is crucial to the habitation of the planet. If heat were to reflect back from the surface of the earth without obstacles, the average temperature of the earth would be $-18\text{ }^{\circ}\text{C}$ instead of $+15\text{ }^{\circ}\text{C}$. In this case, the earth would be covered in ice and uninhabitable.

Most of the shortwave radiation from the sun penetrates the atmosphere to the surface of the earth and parts of it get absorbed and the rest reflected back. Through absorption, the ground will start to heat up and in turn start to radiate energy as long-wavelength thermal heat (electromagnetic radiation). Short-wavelength sun radiation will pass through the atmosphere easily, but a large amount of long-wavelength radiation reflecting back from the ground will be absorbed by greenhouse gasses.

These gasses absorbing thermal heat work like the glass surface of a greenhouse, letting the radiation from the sun through but blocking the energy reflecting back from earth to outer space. Around half of the thermal heat leaving the earth will be reflected back due to the greenhouse effect.

The natural greenhouse effect is very important for earth. The problem occurs when, because of human activity, the level of greenhouse gasses increases drastically and rapidly. The average temperature on earth increases and the accompanying climate changes happen faster and more broadly than humankind and living organisms are able to adapt to.

2.4 Main gasses causing the greenhouse effect

H₂O – water vapour is a weak greenhouse gas, but there is quite a lot of it in our atmosphere, up to 4%. Human activity does not directly affect the amount of water vapour in the atmosphere, but it increase globally due to the rising temperature.

CO₂ – due to the industrial revolution, the carbon dioxide or carbonic acid gas concentration has risen in the atmosphere during the course of the last 200 years from 280 particles per million to 320 particles per million. The carbon dioxide warming effect is approximately 1.66 W/m², which is around twice the amount of all other greenhouse gasses combined (excluding air vapour). CO₂ is mainly emitted through burning fossil fuels, clearcut logging, the breathing of plants, animals and humans and the decomposition of living matter.

CH₄ (methane) – the life span of methane is short, but in the course of 10 years, it absorbs 20-25 times more thermal heat than CO₂ does in a century.

Human activity causing the increase of methane is mainly due to gas leaks and agriculture (mostly rice fields) and a lot of methane is also produced through the collapse of cellulose and the intestinal processes of green grass feeders (e.g. cows).

2.5 History of climate change

Throughout history, changes in the climate have taken place continuously. During the last 400,000 years, there have been three periods when the average temperature of earth has been higher than it is now and this has always been accompanied with a rise in atmospheric CO₂. CO₂ plays a crucial role in absorbing the thermal heat that is reflected.

The greenhouse effect is important for the survival of living organisms, as without it, the average temperature of earth would be 32 °C higher. The problem comes when, due to human activity, the amount of greenhouse gasses emitted is too high and thus causes a steep rise in temperature.

2.6 What does climate change mean for our future?

Due to human activity, the greenhouse gasses released into the atmosphere (CO_2 , CH_4 , N_2O) will put strong pressure on the earth's climate system. Earth is on its way to a new balanced system, which differs from the current state and is a warmer climate.

A warmer earth means a better source of energy to support stronger storms and an increase in major drought and floods. Additionally, the melting of glaciers adds to the rising of sea levels and the exposure of the ground beneath it, which will increase the warming of Earth even more (ice reflects thermal rays, but the ground absorbs it).

Temperature changes up to 2-4 °C above the average will cause the irreversible melting of ice sheets in Greenland, for example, and would be followed by the melting of ice sheets in Antarctica. Excessive addition of freshwater to oceans can interfere with the ocean's deep water salinity level. It could stop the currents and cause the temperature in Greenland and Europe to decrease by 8 °C.

Therefore, the warming of the climate and Greenland would ruin the circulation patterns of currents and cause the cooling of our climate. This will cause a longer vegetation period due to which the forests will grow faster (increase in woodlands). The denseness of the forest will decrease and thus cause more storm damage. This type of timber absorbs less CO_2 and its calorific value is lower.

2.7 Climate refugees in the world

Extreme weather conditions, such as storms, floods, drought, desertification and the rise in sea levels, often cause irreversible changes to the human environment and thus force people to leave their homes. Climate or environmental refugees are people who cannot continue living in their homes due to changes in their environment and have to resettle. This causes global migration and border conflicts.

Additionally, many low income countries lack capacity or there is corruption or, in some places, obstruction by armed conflicts. According to the Red Cross, more people have had to leave their homes because of climate change than armed conflicts. Scientists estimate that if the average temperature increases by 2 °C, the flooding of coastal areas by the year 2100 will force around 100 million people to flee their homes.

The Intergovernmental Panel on Climate Change (IPCC) evaluation estimates that by the year 2050, there could be up to 150 million climate refugees in the world. According to one research study, the number of climate change refugees entering Europe could triple from the present value by the year 2100. If we could reduce global warming, we could bring this number down by a quarter.

2.8 Climate refugees in Estonia

Changes in the climate will make our winters in Estonia shorter and warmer. Snow and frost are in a way our police and border control that determine the habitat area between the border with the north and the south. The community of plants and animals that currently feel at home in Estonia has acclimatised over thousands of years and, in a way, winters have protected their habitat from competitors. The newcomers have to find a place to live at the expense of the current habitat.

Global warming gives way to that by making it easier for other species, who otherwise do not endure cold, to move towards the north. Among them can be quite small newcomers, such as bacteria and viruses that would otherwise perish during winter but would start weakening our nature, including the health of humans.

In the same way, the cold keeps away a larger number of refugees. With the warming of the climate, they are more likely to find their way over here. This can cause a situation where Estonia's cultural heritage is threatened. Warmer summers can also add to the number of visiting tourists that bring more income to the country.

If we do not reduce the current amount of greenhouse gasses emitted to the air, the average temperature will grow compared with that of the pre-industrial era up to 2.6-4.8 °C. This would bring up to 660,000 climate refugees to Europe by the end of the century. Even if the rise in temperature stays below 2 °C, the number of refugees could increase by 28%.

2.9 Animals as climate refugees

The changing climate affects the habitat of plants and animals. The living area for some will decrease, but for others it may disappear completely. Even if the temperature increases by 1.5 °C, it is very likely that 70-90% of coral reefs will die and, if it goes up by 2 °C, the extinction rate could be up to 99%.

Animals would also have to move to a more habitable area or adapt. Warmer winters and rainy summers will increase the number of ticks so there will be an increase in the diseases spread by them. For example, tick-borne encephalitis also occurs among house pets, especially dogs. The rising levels of rainfall will also add to the thickness of glaciers.

For example, with the warming of the climate, the ring seals that live here, by the Baltic Sea, and only nest on ice will lose the place to do this.

The winners of climate change are jackals, whose habitat now extends from Central Africa to the Middle East and through Central Asia to the peninsula of Hindustan. In 2013, it was discovered that jackals also live in Estonia and, in July 2019, it was confirmed that they had also spread to Finland. Though moving north, they are also still living in the south.

2.10 Victims of climate change

Industrialised countries produce more than half of atmospheric pollution, but only one fifth of the earth's population lives in these countries. In the long run, climate change will influence the entire population of Earth, but those most seriously affected will be living in low income countries.

Firstly, they are living in the areas most vulnerable to climate change (Africa, next to big rivers in Asia, small island countries) and their income directly depends on their natural resources. Secondly, they are less capable of adapting to the changing or extreme weather conditions as they lack money or technology. The difficulties that come along with climate change vary from region to region and present with complicated concurrent factors.

With the rise of extreme weather conditions in developing countries, more intense flooding will occur. The warming of the climate will also make fulfilment of the 1000-year plan significantly more difficult. For example, with a 2 °C temperature rise in Africa and South Asia, their Gross Domestic Production would decrease by 4-5%, while in industrialised countries it would be around 1%. This decrease would be caused by the effect of climate change on agriculture, which is the main source of income in Africa and South Asia.

2.11 Diet of humans

Meat-eating animals or carnivores are animals that feed from other animals. The opposite of a carnivore is a herbivore or an animal with a plant-based diet. An omnivore eats everything, be it meat or plants.

Full carnivores mainly eat only meat but can sometimes consume plants in small quantities. Carnivores have developed a short digestive tract, fangs and claws and their eyes are front-facing.

Herbivores are adapted to digest a diet that is rich in fibre. Many have developed wide teeth with which you can consume harder materials. Many plant eaters have developed two stomachs which help them digest plant-based food that is harder to digest than meat. Additionally, they have eyes on the side of their head to help them notice approaching predators more easily. Herbivores usually use most of their waking time for eating. In order to get enough nutrition they have to consume large quantities of food.

It has not been determined where the line is drawn between carnivores and herbivores – this means that there is no exact percentage of how much meat a carnivore should eat to be considered a carnivore and not an omnivore.

Humans are an omnivorous species despite how much meat or plant-based foods an individual eats.

2.12 Organic versus conventional farming

Usually on the fields of organic farms and their surrounding areas, you can find more plant and animal species than on conventional farms. They also have better water and soil quality. But mostly, the harvest is 19-25% less per hectare when using organic farming methods.

Around 95% of crops have been cultivated for general production so that crops cultivated for organic farming give more harvest in the future. Producing the same amount of food using only methods of organic farming can damage the environment more in terms of land use than conventional production.

In low income countries, the health of farmers is a serious problem due to contact with harmful pesticides.

Organic goods might not always have a smaller ecological footprint (for example, if they have been transported a long distance). Organic food has less traces of matter from pesticides than ordinary food. But the allowed level of pesticides is so low in the western world that, according to research, they do not pose any serious concerns.

2.13 Meat production

One of the biggest threats to the diversity of the world's nature is the spread of agriculture and pastures to areas that have thus far been untouched. If a large quantity of animals is kept in a small area, the risk of spreading disease is always high. This is why animals are fed antibiotics to prevent the risk of getting sick. Animals are usually given similar types of antibiotics to those consumed by humans.

The result is the mutation of bacteria and their resistance to antibiotics. These bacteria can then get into our systems when we eat meat, and antibiotics will no longer work for us because the bacteria is resilient to antibiotics. According to studies, we should consume half the amount of meat we do today to lessen the impact on the climate.

Growing animal feed using fertilisers creates extra nutrients, causing the proliferation of bacteria, algae and seaweed. This type of aerobic organism uses up all of the oxygen in the seawater, which results in dead zones that are not suitable for marine life.

By the year 2050, farmers need to produce 150 tonnes more meat than now in order to satisfy worldwide demand.

2.14 Aviation and climate change

Though aviation is quite a small-scale industry compared with others, its impact on the climate is proportionally very big.

It is responsible for up to 4-9% of the impact on the climate due to human activity. This percentage will grow even more as aviation has the highest potential for development out of all other means of transportation.

At a time when we desperately need to decrease the effect of human activity on the environment, the emission of greenhouse gasses by aviation is increasing. For example, since 1990, the amount of CO₂ emitted by international flights has gone up by 83%.

Aviation is growing rapidly, partly due to legislation and tax policies that do not take into consideration the real environmental cost of flying. 'Cheap' prices turn out to be costly due to the impact on the climate and too costly to humankind.

Compared with other forms of transportation like car or train, transportation by air has a larger impact for a distance of one kilometre, even with long distances. This is the most emission-intensive mode of freight transport.

Learn more: counting the amount of CO₂ emissions per flight:

<https://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx>

2.15 Transportation

It is becoming more common for one family to own several cars, and distance covered on foot is decreasing. In 2017, Estonians summarised that the emission of greenhouse gasses was at 20.9 million tonnes. One person's average greenhouse gas emissions per year can be neutralised by planting 30 trees a year during the span of their life, making it around 2000 trees in total per person.

During holidays, we like to travel and often prefer to travel abroad instead of travelling within Estonia. But travelling far means we need to use transport, be it a car, a plane or a ship, but all of these influences the environment. By travelling within Estonia, you save on the amount of CO₂ emitted by air travel. For example, by travelling to Tenerife and back, 700 kg of CO₂ will be produced per person.

2.16 Electric, petrol and natural gas vehicles

Based on current technology used in electric cars, we would have to keep driving them for at least 5 years to make up for the CO₂ released during production and usage compared with cars that run on petrol. Exact productivity depends on several minor points.

A much bigger benefit would be if the owner only drove the car in the city. Even better if the electric car was used to transport several people at once or as a taxi. The production and utilisation of electric cars needs considerably more natural resources than an ordinary car. In this case, the emission of CO₂ is twice as much. In turn, most of it can be attributed to batteries, which can be made them more 'eco-friendly' through development.

Moreover, there is an option to use gas as a fuel (CNG - compressed natural gas). From an environmental standpoint, it is positive that CNG gas stations sell 100% bio-methane, which is completely CO₂ neutral. In addition to using bio-methane gas, local waste recycling is being developed, reducing the need to import fossil fuels and having a more positive effect on foreign trade balance. From 1 July 2019, public transport busses in Tartu are running on natural gasses.

3. STORY CARD

3.1 Qatar cooling tactics

In the Middle Eastern country of Qatar, they have a very hot climate. During the summer months, the temperature rarely goes under 32 °C and during the daytime can reach above 48 °C.

To alleviate the situation, the country has started air-conditioning the outside air. Air conditioners have been placed in open air markets, sports stadiums and shopping centres.

"If you switched off the air conditioners, the heat would become unbearable," says Yousef al-Horr, founder of GORD (Gulf Organisation for research and development for Persian countries). "It is not possible for humans to function in this kind of heat."

Air conditioners might briefly help the locals, but to keep them working, Qatar has to burn fossil fuels to produce electricity. This in turn creates CO₂ that boosts global warming even more, which is what created the current high temperatures.

Even though countries that signed the Paris climate agreement have promised to keep the temperature rise 2 °C higher than the temperature level from the pre-industrial era, Qatar has already crossed this line. This means that the current state of the country might offer a prognosis as to what will start happening in the future in the rest of the world.

3.2 Consequences of extraordinary weather conditions

The devastating 2011 tsunami in Japan dragged thousands of tonnes of debris into the sea. The debris washed up on the shores of Hawaii and Alaska caused an eerie sight. But research shows that the debris was full of all sorts of marine life.

Research published in an issue of the magazine 'Science' on 28 December 2017 claims that this is the first known time in history where such a diverse group of marine life has sailed across the ocean. From spring 2012 to spring 2017, Ruiz and his colleagues counted at least 289 species of fish and invertebrates that arrived alive with the debris to the coast of the USA. None of them has been known to succeed in crossing the ocean before, but Ruiz explained that the species had not had the opportunity to make such a journey before.

Researchers are afraid that the foreign species carried by the debris can harm the local ecosystem. So far it is not clear whether any of the foreign species from Japan have started to colonise the areas where the debris washed ashore in California, Oregon and other areas. Researchers are pointing out that it is too early to say, as these processes take years.

3.3 Life in lower income countries

Tara Begum is an ordinary farmer in Bangladesh who lives by the shores of the Brahmaputra River and is used to seasonal floods. But in recent years, the Brahmaputra River has become unpredictable. Tara no longer knows how to predict the next flood waters or when to sow the seeds.

She was forced to relocate her home five times before the river completely took over her land. Other farmers were eagerly waiting for the monsoon rain to arrive so they could plant their seeds. The first rainfall came; farmers were happy and planted the seeds. But this rainfall was to remain the only one and the seeds dried up – that year's harvest was ruined.

You hear these types of stories from around the world. The climate has become unpredictable. People have come to the realisation that yearly floods have become more serious. Fields are built on elevated areas and freshwater ponds with fish are created so that people would have food during the floods.

Every year 26,000 km² (18% of the surface area) is flooded, over 5000 people perish and 7 million homes are destroyed. During bigger floods, the flooded area can cover up to 75% of the country's land (as happened in 1998). By the end of the century, most of the fertile land could ultimately end up underwater.

3.4 Principles of young activist Greta Thunberg

Greta Thunberg, born on 3 January 2003, is a Swedish activist who is focused on fighting global warming.

To spare the environment, she refuses to fly and travels to far away places mainly by train. For example, to go to Davos she had to take a 32-hour journey by train, and to London she has traveled by train or electric car. To travel from New York to Montreal she was lent an electric car by Arnold Schwarzenegger.

On 14 August, she started her travels from Plymouth, UK, to the USA, where she attended the UN climate conference. She sailed with a Malizia II sailing yacht, which takes around 2 weeks to cross the North Atlantic Ocean.

German Die Welt wrote that crossing the Atlantic with the yacht brought about five continental flights and their resultant pollution. Yachtsman A. King said, "the Malizia II yacht is hard to navigate in the harbour and requires maintenance after the trip. Because of that, it is accompanied by things that are not so sea friendly."

Besides that, Thunberg has given up buying new clothes and has applied a strict purchase ban for herself. She buys second hand clothes, wears clothes given as presents and borrows clothes from family members. She purchases new things only if it is absolutely necessary.

3.5 Polar bears

In 2017, National Geographic published the story 'This is what climate change looks like'. They showed photos and a video of a clearly starved polar bear. This shocked the whole world. The animal was weak, collapsed several times and was looking for food from dumpsters. The biologist accompanying the photoshoot said that global climate change is to blame for the animal's suffering, that it has melted the ice and snow, making it harder for polar bears to catch seals.

That video has been viewed by millions of people. Among them is polar bear expert Inuit Leo Ikakhik, who has seen a lot of dying polar bears. He is convinced that the polar bear seen in the video is not suffering from the consequences of the warming climate, but its condition has to do with the animal being sick or wounded. Ikakhik says that the animal has probably been injured while fighting with another polar bear or is suffering from intestinal parasites. "But climate change is definitely not the cause. Signs of the consequences of global warming cannot yet be seen in the Arctic," he points out.

Later on, the editorial staff of National Geographic admitted that they had made premature assumptions about the polar bear. Though scientists have made certain that the melting of sea ice is closely linked to the dying of polar bears, it is not possible to know for sure why this polar bear was in such situation.

3.6 Adaption of plant production

To meet growing demand, agriculture needs to produce 50% more food, feed and biofuel by the year 2050 than was needed in 2012. Growth must be achieved mainly through yield productivity, under 1% growth of yield is not enough.

A lot of research shows that productivity will decrease in the long run. Deterioration of natural resources and climate change are altering the dynamics of pests and diseases, increasing plant disease outbreaks and the spread of pests. Agriculture is affected by the growing trend in the number and intensity of natural disasters around the world.

In spite of this, in order to be successful in growing crops in Estonia, crop varieties need to be developed to suit the changing conditions.



For example, the tomato plant is relatively intolerant to cold- and warm-loving plants from the tropics and is susceptible to potato blight, which spreads easily. For this purpose, a more suitable plant for our climate is being bred in Jõgeva. The cultivated varieties are more resistant to temperature fluctuations and common plant diseases and are tasty. However, such plants need more water and 1.5 times as much fertiliser as other varieties. Fertilisers based on horse or cattle manure are the most suitable, but nettle water is also suitable.

4. QUESTION CARDS

QUESTION CARD 1	QUESTION CARD 2	QUESTION CARD 3	QUESTION CARD 4
Who is affected by climate change?	What would happen if the entire human population went on a plant-based diet?	What can I do to reduce the effects of climate change? Check out how you can calculate your own ecological footprint: http://jalajalg.positium.ee	What might the most valuable resource be in the future?
QUESTION CARD 5	QUESTION CARD 6	QUESTION CARD 7	QUESTION CARD 8
Will humans get through all of the environmental changes using only their own knowledge?	What part of nature can humans not go against?	How can we balance out or reduce the amount of CO2 emitted to the atmosphere?	Which option would you choose? a. Buy a cheap petrol/diesel car and pay large amounts for fuel. b. Buy an expensive electric car and pay less for fuel. c. Other. Why?

5. WORKSHEETS

Topic
CLIMATE CHANGE
Resolution
Choose the debate resolution

Prepare a set of arguments and group them into those that are clearly PRO the resolution, AGAINST the resolution and those arguments that can be used by both sides. Enter them in the appropriate places in the table.

PRO	DEBATABLE	CON



Prepare arguments for the discussion. One group of students prepares arguments supporting the resolution, the other one has contradictory arguments. Use the proposed scheme.

ARGUMENT NO. 1.

Argument	Foreseen rebuttals of the other group	Answers to rebuttals

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ARGUMENT NO. 2.

Argument	Foreseen rebuttals of the other group	Answers to rebuttals



Worksheet for the public

Name and surname: Class: Team: proposition/opposition

During the debate, hear and observe carefully the speeches of the debates from the other team. Then, evaluate which speech convinced you the most and which areas of your opponents' speech should be improved.

1. In terms of **argumentation** (e.g. the quality of the arguments presented, credibility of the data and scientific evidence) in the rival team I was most convinced by the speaker No.

Reason:

.....
.....
.....

2. In terms of **the style of presentation and communication with the audience** (e.g. confident, persuasive, authentic and dynamic posture, moderate gestures, assertive voice variety, good eye contact with the audience, use of moderate humor, friendly and professional approach to all participants, effective use of body language) in the rival team I was most convinced by the speaker No.

Reason:

.....
.....
.....

Indicate the element of the rival team's performance that requires improvement. Justify your answer.

.....
.....

Reason:

.....
.....
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.....
.....





Climate change

Recommendations for teachers on using teaching materials

The educational package "Climate change" was developed within "Oxford debates for the education of young people in the field of mathematics and science" project.

It is a key material, facilitating the achievement of primary project goals, including increasing reasoning skills and interest in STEM, which in the future may result in taking up a scientific career.

When preparing students for the debate, one should not neglect the development of such skills as communication excellence, argumentation or public speaking. Students should improve their ability to persuade effectively, argue properly, reason accordingly and speak out correctly. Composition of texts, using rhetorical means in oral statements, speaking in accordance with the rules of language culture, text interpretation, public speaking and presentation of texts, discussions and negotiations are of equally high importance.

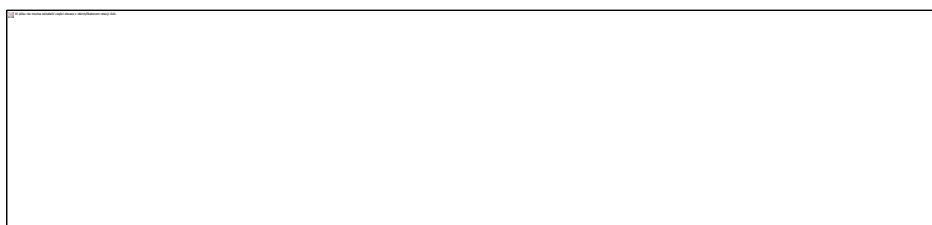
In order to achieve the abovementioned goals, the implementation of thematic educational packages should be preceded by classes dedicated to preparation for debating as such. This can be accomplished in consultation with teachers of other subjects and the class teacher. The development of basic communication skills can be included in the class teacher's work plan, and the prepared lesson plans can be used during regular classes. Auxiliary materials can be found in the following documents:

- Warm-up practice – [Frameworks for implementation of Oxford debates in STEM in school practice](#) ;
This document includes the following exercises: active listening, public speaking and debating skills and lesson plans.
- [Methodological Guide for Teachers. ODYSSEY: Oxford Debates for Youths in Science Education](#)

The teaching material pack includes the following:

- Student worksheet for drafting arguments,
- Information, story and question cards
- links to additional materials
- scientists' video.

Ideally, 2-3 hours should be taken per pack in order for the students to grasp the essentials of fact-based debating. The first lesson should focus on what debating entails (assuming that the





students have no experience of it). The second lesson should make use of the materials in one of the themed packs. For the second lesson there are two possible lesson plans - A) can be used if the students are already well familiar with the topic and/or debating, B) is more structured and better from starting from the very beginning. The third lesson should then include an actual debate. If you don't have enough time to give feedback on the debate during the lesson, you can do so during the following lesson.

Albeit the environmental topics within the materials are covered quite broadly, depending on your region you might need to give your student some additional information (links to newspapers, homepages, videos) regarding your own locally relevant topics. For example, the invasive species for biodiversity package in your region might be completely different or perhaps the energy can be produced by means other than the ones that have been covered in the materials (perhaps instead of oil shale in your region geothermal energy, oil or coal plays an important role).

Below you will find lesson plans you can use, adapting them to your group and your particular aims. Once the debates have been held, we look forward to your feedback on the themed packs and other materials. Enjoy some lively debating!

Lesson Plan 1: Introduction to Debating

During the first lesson, the students are introduced to the format of debates. We recommend that you practise drafting arguments and thinking about likely counter-arguments and how to rebut them. The student worksheet included in the pack will be of help.

Lesson aims:

By the end of the lesson, the students know:

- what debating is; and
- what an argument is.

By the end of the lesson, the students understand:

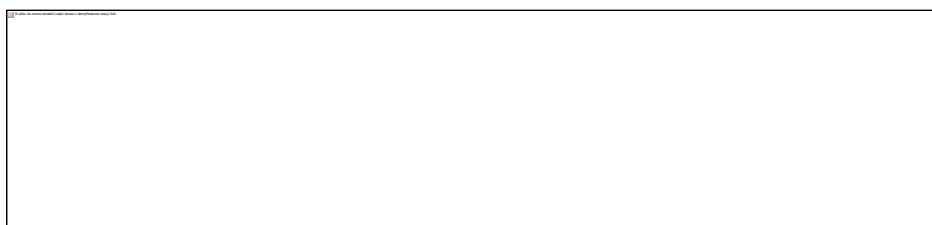
- how a debate is structured.

By the end of the lesson, the students are capable of:

- drafting, supporting and rebutting arguments.

Lesson preparation:

- Remind yourself of what you learnt during your debate training.
- Print out the student worksheets.
- If you wish to, laminate the worksheets (so that they can be re-used if the students write on them with felt-tips).





Lesson Plan 2, Option A: An Introduction to Climate Change

For the second lesson you can prepare the materials of climate change. Remind the students of what they have learned so far in regard to them, explain the key terms and their definitions and set out the problem. You could also have the students watch the scientist's video lecture that forms part of the teaching materials. Look at the information, story and question cards together, which you will also find among the teaching materials. Point out that the students can use these cards, as well as their own notes, during the debate. You don't need to discuss the actual topic yet – simply provide an overview of the themed pack. At the end of the lesson, choose a specific topic for debate to continue with in the following lesson. As a home task, get the students to search for extra information. Links can also be added as part of the additional information for the topic in the e-school for them to investigate.

Lesson aims:

By the end of the lesson, the students know:

- the key terms associated with the topic and their definitions; and
- the nature of and background to the problems.

By the end of the lesson, the students understand:

- the structure and use of the materials in the themed pack.

By the end of the lesson, the students are capable of:

- navigating their way through the materials in the themed pack.

Lesson preparation:

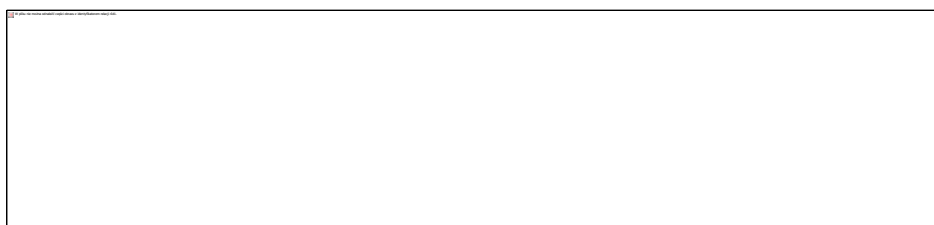
- Prepare the video lecture (which you will find among the teaching materials).
- Print out the relevant information, story and question cards and cut them to size as indicated.
- Add links for the given topic to the e-school for the students to investigate at home.

Lesson Plan 2, Option B: An Introduction to Climate Change

Divide the class up into groups of three, who are then given topics for debate. Note: Keep one topic of debate as a spare – don't give it to the students.

Activities prior to preparing for the second lesson (i.e. up to the home task):

Distribute the information and story cards among the students so that each group has one of each.





Depending on the age of the students, familiarity with the topic etc you can decide on if you a) give each group all the cards; b) decide to divide the cards between the groups; or c) give each group just a specific selection of cards. You as the teacher know your student's abilities the best. Depending on your students you can have them work on the cards as a group by discussing all the cards together (this is preferred) or even have them divide the cards between them.

The links provided in the additional material should also be made available to the students online ahead of the lesson. Get the students to familiarise themselves with the topic on their cards. Set them the following task:

On your own, read your information and story cards. Read them through first, then take a look at some of the sources listed in the additional materials (such as watching a video or reading an article). Then note down the following about the card:

- *What are the 2-4 most important facts on the card?*
- *Look at the topic of debate given to your group. Decide whether the facts you have noted down support the topic or rebut it.*

During the lesson:

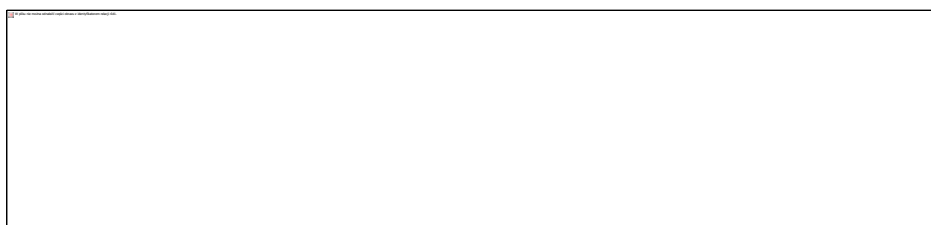
Have the students sit in their groups. Give each student two minutes to introduce to their group their card and the facts listed on it. Here, the students need to explain to the other members of their group what decision they came to regarding the facts, i.e. whether the facts support the topic or rebut it.

Remind the whole class what they have learned so far about the themed pack, repeat the key terms and their definitions and help the students link the information from their cards to the information they have obtained from the other members of their group. If needed use the "worksheet for the public" in the end of student's thematic packages where other students who listen to the debate can evaluate which speech convinced them the most.

[Watch the scientist's video lecture](#) (or other videos among the teaching materials that seemed the most interesting to the students) during the lesson.

By this point, the class should be quite familiar with the topic. Use the question cards to repeat what they have already learned from the information and story cards. Ask the students questions and let them take a standpoint in regard to them. If the classroom space allows, you can even do this physically – for example, dividing the room in two using tape on the floor, with one side being 'Yes' and the other side being 'No', and having the students choose one or the other depending on their standpoint. Give all of the students on the same side of the line 30 seconds to decide what their main argument is and why they think so.

Also take a couple of minutes to discuss whether the topic seems straightforward or complicated to them, giving them the chance to air their views and argue over them. Allow them the opportunity to say what the most interesting thing they have learned during the lesson is.





At the end of the lesson, inform the students what the topic of debate for the next lesson will be (i.e. the one you previously held back as a spare). Point out that the students can use the cards they looked at in the lesson, as well as their own notes, during the debate. Ask the students to start working on worksheet 1 and worksheet 2, so they can try to create the arguments, rebuttals and answers. At this point they can try it out for themselves and you can support them as they find out what is most difficult for them.

As a home task, get the students to search for extra information. Links can again be added as part of the additional information for the topic in the e-school for them to investigate. The students should finalize the worksheets as groups as a home task (away from other groups that could otherwise hear their arguments).

Lesson aims:

By the end of the lesson, the students know:

- the key terms associated with the topic and their definitions; and
- the nature of and background to the problems.

By the end of the lesson, the students understand:

- the structure and use of the materials in the themed pack.

By the end of the lesson, the students are capable of:

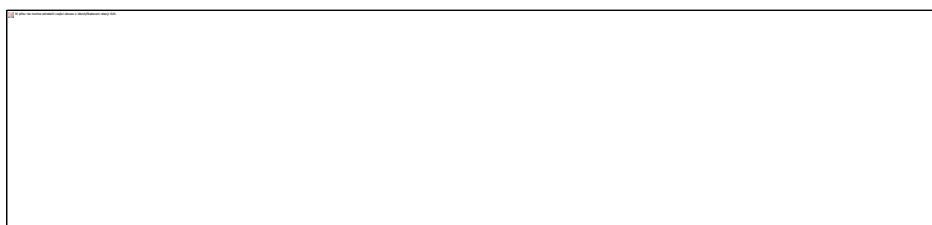
- navigating their way through the materials in the themed pack.

Lesson preparation:

- Select the themed pack to investigate.
- Print out the relevant information, story and question cards and cut them to size as indicated.
- Put together three-member groups.
- Distribute the topics of debate among the groups. Note: Keep one topic as a spare.
- Distribute the cards within the groups.
- Add links for the given topic to the e-school for the students to investigate at home.

Lesson Plan 3: debate on „In order to curb the effects of climate change, every person must forgo at least one flight. “

The third lesson sees the students start debating. Randomly divide the students up into ‘Yes’ and ‘No’ camps. You can use the information, story and question cards and the students’ own notes on the student worksheet as supporting material. The duration of the Odyssey debate class format is 45 minutes, but factor in the time it will take to give feedback (giving it in the





following lesson if possible). You can get the rest of the class involved in assessing the performance of individual debaters by getting the students to listen to them carefully and make notes during the debate. Worksheet 1 and Worksheet 2 are for the help for the teacher.

Lesson aims:

By the end of the lesson, the students understand:

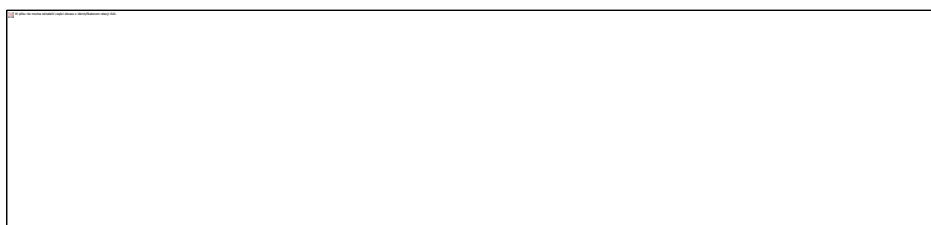
- how a debate is structured; and
- their role in the debate.

By the end of the lesson, the students are capable of:

- applying topic-appropriate knowledge in a debate format;
- expressing themselves clearly and comprehensibly (including in terms of their diction);
- predicting counter-arguments; and
- supporting their own arguments and rebutting others.

Lesson preparation:

- Set up the classroom for the debate, rearranging the desks and chairs as necessary.
- Prepare the required information, story and question cards (using ones that have not already been used if possible, or printing out new ones).
- Prepare the student worksheets (using ones that have not already been used if possible, or printing out new ones).





WORKSHEET NO 1 – answers

PRO	GREY AREA	CON
<p>How does aviation affect the climate?</p> <p>Although aviation is a relatively small industry compared to other branches of the economy, the effect it has on the global climate is disproportionately large: it accounts for up to 9% of the total impact of human activity causing climate change. And that figure is growing all the time, because flying has some of the greatest development prospects of any form of transport.</p> <p>At a time when we desperately need to be reducing the impact of human activities on the environment, emissions of greenhouse gases from aviation are on the rise. For example, the amount of CO₂ emitted by international air traffic has increased by 83% since 1990.</p> <p>Compared to other forms of transport, such as cars and trains, planes have a much greater impact per kilometre travelled by passenger, even over longer distances. It also produces the most emissions as a form of goods transport.</p>	<p>As means of transport go, are electric cars a good choice?</p> <p>Electric cars based on current technology need to be driven on average for up to five years before the CO₂ generated in their production and ignition falls below the level that would otherwise be generated if using petrol as a fuel source. That said, exactly how long this takes depends on dozens of factors. The benefits of electric cars are seen much sooner if their owners only use them in built-up areas; all the more so if they are used as taxis or for ride-sharing. The manufacturing and use of electric cars require significantly more natural resources than the production of ordinary cars and produce almost twice as much CO₂. This is mostly down to the batteries used in the vehicles, which if developed and improved would make electric cars even more 'eco'.</p> <p>Another potential fuel source is compressed natural gas or CNG. From an environmental point of view, it is a major plus that CNG outlets sell 100% biomethane, which is considered 100% CO₂-neutral. Biomethane also promotes the circular economy for local waste, which among other things reduces the need to import fossil fuels, therefore having a positive effect on the balance of foreign trade. All buses on city routes in Tartu have been running on gas since 1 July 2019.</p>	<p>How can we offset or scale back CO₂ emissions?</p> <p>The carbon generated in an average year by a single driver can be offset by planting at least 30 trees a year, which amounts to around 2000 trees in the driver's lifetime.</p> <p>Compressed natural gas or CNG can be used for fuel instead of petrol. From an environmental point of view, it is a major plus that CNG outlets sell 100% biomethane, which is considered 100% CO₂-neutral. Biomethane also promotes the circular economy for local waste, which among other things reduces the need to import fossil fuels, therefore having a positive effect on the balance of foreign trade.</p> <p>If possible, walk or cycle more.</p> <p>To reduce climate change connected to meat production, studies suggest we should be eating around half as much meat as we currently are.</p> <p>Use as few devices as possible that require power and choose them according to their energy rating.</p> <p>When buying items, choose those likely to last longest and then use them for as long as you can.</p>



WORKSHEET NO 2 – examples of argument

ARGUMENT	FORESEEN REBUTTALS OF THE OTHER GROUP	ANSWERS TO REBUTTALS
<p>When it comes to holidays, we like to travel – and when it comes to travelling, we often prefer to go abroad. But when travelling further afield we need some form of transport to take us there, whether it be a car, a plane, a ship or something else entirely, and they all have an impact on the environment.</p>	<p>When people want to travel long distances, they generally choose to fly. If you were to travel the same distance by car, it would also generate a lot of CO₂ but without fitting in as many people, so your footprint would potentially be even greater than if you flew.</p>	<p>But on the whole, compared to other forms of transport such as cars and trains, planes have a much greater impact per kilometre travelled by passenger, even over longer distances. They also produce the most emissions as a form of goods transport.</p>
<p>But since out of all of them it is planes that generate the most CO₂, our position is that everyone should forgo at least one flight in order to curb the effects of climate change.</p> <p>At a time when we desperately need to be reducing the impact of human activities on the environment, emissions of greenhouse gases from aviation are on the rise. For example, the amount of CO₂ emitted by international air traffic has increased by 83% since 1990.</p> <p>Thus, by reducing the number of flights, we can significantly reduce the amount of emissions.</p>	<p>There are a variety of far more effective ways of easing the burden we each place on the environment than forgoing a flight.</p> <p>The carbon generated in an average year by a single driver can be offset by planting at least 30 trees a year, which amounts to around 2000 trees in the driver’s lifetime.</p> <p>To reduce climate change connected to meat production, studies suggest we should be eating around half as much meat as we currently are.</p> <p>You can also take holidays in your own country, avoiding the need for any emissions-heavy flights.</p> <p>There are also professions where travel is vital, so forgoing flying is not an option: pilots, for one, and international specialists, for example.</p>	<p>The extended vegetation period caused by climate change means that trees are growing more quickly in forests (with more new growth), resulting in lower wood density, which in turn increases the risk of storm damage. Such wood is also less effective at storing carbon and its calorific value is lower.</p> <p>Moreover, people who live in the city don’t have the room to plant that many trees.</p> <p>If we ate significantly less meat, a lot of people who currently work in the industry would lose their jobs and land would go fallow.</p>