

Theme 7. Air

Teacher guide - Ages 11-14

Preparation

Review the material and watch the videos. Do some preparation on the topic. For the Introduction some materials are required: garbage bag, plastic bag, sandwich bags. Let the students use the sandwich bags from their lunch. For the Outdoor Experience think of a place in a park or forest you can go to. Feel free to add any resources or materials you have available to enrich the lessons. Also check the *Introduction lesson Teacher guide* for useful tips and suggestions for preparing and giving the lessons within a theme.

Learning Goals

The students ...

- learn what nitrogen, oxygen and CO₂ are.
- know what air pollution is and what causes it.
- know the terms nitrogen oxides and ammonia.
- know how to reduce air pollution.
- know what balance in the composition of air means for the environment.
- know that plants and trees are important for humans, animals and nature.
- know what photosynthesis is.
- know the term deforestation.
- know how they can reduce CO₂ emissions.
- want to tell others what they have learned.

Key Vocabulary

- air
- atmosphere
- nitrogen
- oxygen
- CO₂ (carbon dioxide)
- compound
- nitrogen oxides
- ammonia
- smog
- CO₂ emissions
- exhaust fumes
- manure
- balance
- photosynthesis
- deforestation
- felling of trees
- air pollution
- the cow toilet



Introduction

[Slides 3-4]

Divide the class into groups. Give each group an empty plastic bag. Tell them to fill the bag, but without any objects. Ask students to get creative and help hint at air if they get stuck. The point being that they fill the bag with air. They can fill the bag in a variety of ways, including blowing air into the bag, filling the bag with air from the room or going outside to catch some wind (other options are also possible). Ask students to close the bag. Together, discuss what air is. You cannot grasp it or hold it but you can fill a bag with it. If students are able to close the bags (with a seal) they should be able to notice that air can also be strong. Do the students think that the air in the bag is clean or contaminated? Does it matter where the air came from?

After this, discuss the learning goals of this theme.

Instruction

[Slides 5-7]

Problem

Watch the film and complete exercise 1.

Air is a mixture of gases floating in our atmosphere. Air is made up of 78% nitrogen, 21% oxygen and 1% of other gases including CO₂. Gases can cause problems, if they are not in natural balance.

[Slides 8-11]

Nitrogen

Let's first take a look at nitrogen.

Nitrogen is a gas that you cannot see or smell. Humans and animals need it. We breathe it in and out. Watch the film.

Nitrogen oxides and ammonia

nitrogen oxides end up in the air through gases from traffic and emissions from industry.

Ammonia mainly comes from animals in livestock farming.

Complete exercise 2.

Discuss exhaust fumes: *Where do we find them?* (For example: on roads from cars, factories, construction sites from construction machines)

And manure? (On farms, manure from chickens, pigs and cows).

Complete exercise 3.

[Slides 12 - 15]

Consequences for humans (and animals)

When more nitrogen oxides and ammonia come into the air, we speak of air pollution. What problems does this cause for humans?

We breathe in these substances which are not good for us. Also, people with lung conditions become more ill. Some days there is more air pollution and people suffer more on those days. Have the students ever been affected by air pollution?

Watch the film.

Complete exercise 4.



Consequences for nature

A lot of nitrogen oxides and ammonia in the air is not only harmful to humans and animals. Also nature is affected. When these substances fall onto the ground in the form of precipitation, the soil becomes too rich in nutrients. This is not good for plants that grow in low-nutrient soils. These plants disappear and then the animals that eat these plants die out.

[Slides 16-18]

Photosynthesis (Oxygen and CO₂)

Watch the film about photosynthesis and complete exercise 5.

Trees and plants are important for life on earth. They absorb CO₂ from the air.

[Slides 19-22]

Watch the video. By producing all this CO₂, more CO₂ remains in the atmosphere. This makes it warmer on Earth.

Complete and discuss exercise 6.

More CO₂ in the atmosphere warms the Earth.

Ask the students: *What are the consequences of a warmer planet?* Discuss the answers.

- *Drier areas are becoming more arid (drier); deserts are forming, farming is no longer possible.*
- *There is more extreme weather (extreme rainfall)*
- *Ice caps are continuing to melt; sea level is rising and more areas are flooding.*

[Slides 23-26]

Watch the film about deforestation.

Complete exercise 7 and explain the answer.

With water and carbon dioxide, trees use energy from sunlight to make their own food. The leftovers from making this food is oxygen. We need oxygen to breathe and we breathe with our lungs.

Complete exercise 8.

Explain that the Amazon is the largest and most diverse tropical rainforest (situated largely in Brazil). *It is important for the whole world that the forest fires and the felling (cutting down) of trees in this forest stops as quickly as possible.*

A solution

[Slides 27-29]

What can we do to ensure that our air stays clean and healthy?

Nitrogen

The key to nitrogen is to lower the emission of nitrogen compounds (also known as nitrogen oxides). This means less exhaust fumes and less manure.

Complete and discuss exercise 9.

- *The faster cars drive, the more polluting gases they emit. That is why speed limits are being introduced in more and more places. Lower speeds means less exhaust fumes.*



- *The older a car is, the dirtier the exhaust fumes are. Cars 15 years and older count for 35% of the total amount of nitrogen oxides released by car traffic. Old cars that run on diesel are extremely polluting.*
- *Electric cars do not emit any gases. An electric car is not free of pollution, but a better option.*

[Slides 30-33]

Then show how farming and cows in particular are part of the nitrogen problem. Explain how the cow-toilet works. (It keeps the urine and manure separated, to reduce the amount of ammonia gas.)

Complete exercise 10.

[Slides 34-35]

Governments are currently busy tackling the nitrogen problem. Watch the film.

Then ask students to form groups and discuss one of the following possible solutions.

[Slides 36 & 37]

Watch the film.

Ask the students what is meant by a carbon footprint. (*Total amount of CO₂ emission by one person*). What kind of things do you think determine what your carbon footprint is? For example: *how you travel, the things you have in your house, what you eat and if you buy new or second hand items.*

Complete exercise 11. Possible answers are:

- *Limit air travel.*
- *Use energy-efficient home appliances.*
- *Cycle instead of traveling by car.*
- *Use public transport instead of the car.*
- *Switch to renewable energy (solar panels).*
- *Eat less meat.*

Discuss the exercise including the term 'compensate' that was used in the film.

CO₂ emissions that you cannot reduce, you could compensate. For example, by donating to a climate project. What do the students think about that? Is something like that possible? What do the students think is the best thing to do: reduce or compensate CO₂ emissions?

Extra info: Explain that one often speaks about reducing nitrogen instead of reducing nitrogen compounds. Nitrogen in itself is not the problem. The problem is the compounds that are formed in the air when nitrogen mixes with exhaust fumes and manure. One talks about nitrogen instead of nitrogen compounds, probably because it is shorter and less confusing.

What can you do?

[Slides 38-40]

Governments are taking steps to reduce the emission of nitrogen compounds. But you can also do something.

Have students complete the sentences. Possible answers include:

- **I ask to be taken less by car and cycle more often, so that there are less exhaust fumes so that less nitrogen oxides come into the air, and pollutes the air less.**
- **If I eat less meat, there is less livestock needed and so less manure. In turn, there is less ammonia in the air, and less air pollution.**



Tell students that they now know different possibilities to reduce their CO₂ emissions. Ask students what they are going to do to reduce their own CO₂ emissions. Complete exercise 12. Remind students that any steps they make have an impact.

Complete exercise 13.

Possible answer: *There are plans to cut down the trees here which people are protesting. Because trees are important for our environment and clean air. It is a play on words. To cut it out is a way of saying stop, but also means to cut down trees.*

Discuss with the students what their part could be in planting trees. Are there trees in the neighbourhood? Is the school actively planting trees? And what can they do to stop forest fires and forests being cut down?

Suggested related themes

Theme 1 about climate change, the consequences of high CO₂ emissions is discussed. Theme 8 about trees shows what problems are caused due to deforestation.

Practical Assignment

[Slide 41]

Make a vlog

Make a vlog about the topic: air. Use your vlog to share with others what you know about this topic. Share what you know about the air and air pollution and what the solutions to the problem are. Watch the film for tips about how to make a vlog.

Worksheet

[Slide 42]

Let the students complete the worksheet. Some students can present their answers from exercise 3. Exercise 5: What do the students think of the title? Exercise 6: Should old cars be banned? Is manure only a problem for farmers? What do the students think?

Discuss exercise 7. What do the students think about a 'car-free Sunday'? Will this work and help? Show in exercise 8 what you personally are going to do. Is there something in the classroom that can be changed?

Closing

[Slide 43]

Review the learning goals and make arrangements with the students about how and when they can continue working on their practical assignment (making a vlog). Watch the vlogs together.

Outdoor Assignment

[Slide 44]

Visit two very different places, for example a busy intersection with lots of traffic and a park. Make sure everyone can stand/sit in a safe place. The students take a few deep breaths. How do they experience this in these different places? Also ask which place they find more pleasant and let them explain why.



Extras

[Slide 45-50]

Game: Hangman

Exercise 1

Students look up information about The Amazon and answer the questions.

Extra films

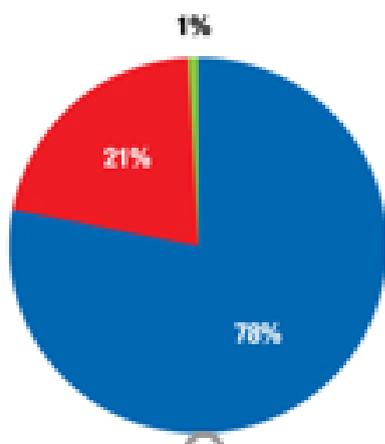
Materials Required

For the Introduction some materials are required: garbage bag, plastic bag, sandwich bags. Students could use the sandwich bags from their lunches. For the Outdoor Experience think of the busy and calm places that you could safely bring the students to.

Theme 7. Air

Answer key - Ages 11-14

Exercise 1



The following ratio is drawn in the circle: 78% nitrogen, 21% oxygen, 1% other gases including CO₂.

Exercise 2

- These gases form when fuel is burned at high temperatures.
- Trees and plants absorb CO₂ from the air.

