

Theme 7. Air

Teacher guide - Ages 8-10

Preparation

Review the materials 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 how important the (balance) in the composition of air is.
- 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
- the balance
- photosynthesis
- deforestation
- cut down (to be felled)
- air pollution
- the cow toilet



Introduction

[Slides 3 - 5]

Pull the cord and have students guess at the riddle. Does anyone get the answer 'air'? To help make air visible to the students, have them breathe on a mirror or on a window. What happens? They should see the water vapor from their exhalation fog up the mirror/window. After this, discuss the learning goals of this theme.

Instruction

[Slides 6-9]

Problem

What is air? Watch the film

Complete exercise 1. There is more than one right answer. Watch the next video to discover why the sky is blue.

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. Every gas can cause a problem.

[Slides 10-12]

Nitrogen

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

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

Ammonia: Ammonia mainly comes from animals in livestock farming.

Watch the film and complete exercise 2.

[Slide 13-16]

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.

On days with sunny and calm weather, there can be more pollution, affecting more people. This happens when there is little movement in the air and a lot of air pollution. This is called smog.

Complete exercise 3.

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 soil. These plants disappear and then the animals that eat these plants die out.

[Slides 17-19]

Photosynthesis: Oxygen and CO₂

Watch the video about photosynthesis. *Plants need sunlight, water and CO₂ for photosynthesis.* Complete exercise 4.



Trees and plants are important for life on Earth. Trees and plants absorb and store CO₂ from the air.

[Slides 20-22]

Watch the film.

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

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

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

Complete and discuss exercise 5.

[Slides 23-25]

Watch the film about deforestation.

Complete exercise 6 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.

Discuss forest fires and the effects they have on the atmosphere.

A solution

[Slides 26 - 28]

What can we do to keep our air 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 7.

- *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.*
- *bikes do not emit any gases.*

[Slides 29-30]

Watch the film and discuss the main ideas. Complete exercise 8.

Possible points to discuss include: *Reducing meat consumption also decreases meat production, by doing so you reduce the amount of transport of animal feed, animals to be processed, and processed meats. This means less emissions.*

[Slide 31 - 34]

Then discuss how farming and cows in particular are part of the nitrogen problem.

Explain how the cow-toilet works. Complete exercise 9.



[Slide 35 & 36]
Oxygen and CO₂

We need O₂, but why is it a problem? There is too much CO₂ in the air, because of human actions. That's why we need to reduce CO₂ emission. Besides that, we can plant trees (trees capture CO₂)

Have students form groups. Have the groups discuss what their carbon footprint is. Use the images provided to help come up with answers.

Discuss their answers as a class.

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.*

What can you do?

[Slides 37 - 38]

The government is taking steps to reduce the emission of nitrogen compounds. But you can also do something.

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.

Complete exercise 10.

Possible answers:

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 11. Remind students that any steps they make have an impact.

Suggested related themes

In 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.

Worksheet

[Slide 39]

The students complete the worksheet.

Discuss the worksheet answers. Exercise 3: The students think of a type of smog in their own country. Smog occurs when it is sunny and there is little movement in the atmosphere. The air pollution does not move, but lingers, creating this polluted mass.

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Exercise 5 shows a title from a government survey. What do the students think of the title?

Exercise 6 looks at the people who play a role in air pollution. 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?

Practical Assignment

[Slide 40]

Make a vlog

Make a vlog about the topic: Air. 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.

Closing

[Slide 41]

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 Experience

[Slide 42]

Compare

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 in and out. How do they experience this in these different places? Also ask which place they find more pleasant and let them explain why.

Extras

[Slides 43-48]

Game: Hangman

Exercise 1

Discovering and measuring air pollution.

Exercise 2

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

Extra films

Materials Required

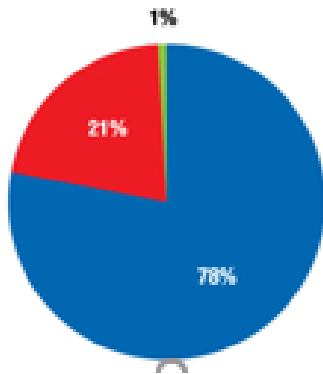
For the Introduction handheld mirrors or enough window space for students is required.

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 8-10



Exercise 1:

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

Exercise 2:

- The pollutants nitrogen oxides and ammonia are created in the air because the nitrogen combines with exhaust gases (forming nitrogen oxides) and with manure (forming ammonia).
- Plants and trees are important because they absorb CO₂. It is good that CO₂ is taken out of the air. They also produce oxygen. Let some students present their answers from exercise