



Atmosphere

The air surrounding the Earth is called the atmosphere. Clean air in the atmosphere has no colour or smell, which is why we often forget it is there. We even say things like “The glass is empty,” and “there is nothing in the corridor.”

What is air? It is a mixture of nitrogen (78%), oxygen (21%), carbon dioxide (CO₂), a number of inert gases and some water vapour. There are some natural impurities in the air, like dust and volcanic ash, as well as pollution from human activities.

Many people think that the sole value of the atmosphere is to provide us with air to breathe, but there is more to it than that. The atmosphere also:

- holds down the temperature on the surface of the Earth, which makes it possible for the living organisms to exist.
- determines the climate of the Earth;
- filters much of the harmful ultraviolet rays of the sun, which are harmful for people, plants and animals;
- dissipates the smoke and noxious gases released as a result of natural processes and human activities;
- serves as a reservoir for various gases which sustain life;
- plays a major role in the natural water cycle;
- transmits sound waves, which makes hearing possible; and
- is the medium in which various smells and flavours spread, which is important for pollination of plants and the orientation of the animals.



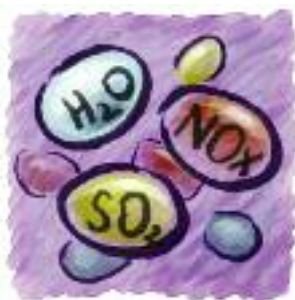
People use air in their daily lives. For example, compressed air is pumped into the tyres to keep them inflated, and various machines are driven by it (e.g. for breaking concrete). Mountain climbers and divers use compressed oxygen bottles when they climb high mountains or dive deep underwater.



Plants and the animals depend on the gases in the atmosphere. Plants need carbon dioxide for photosynthesis, after which they release oxygen, which, of course, is taken in by animals, who then exhale carbon dioxide.

Nowadays the burning of fuel, the processing of waste, intensive agriculture, transport and other human activities pollute the air. Polluted air harms human health, plants, animals and natural habitats, and it can also bring about changes in the climate. Exhaust gases from transport, for example, consist of more than 200 chemical compounds, most of them harmful to human health and the environment.

Until recently, scientists believed that after their discharge into the atmosphere, the concentration of pollutants diminishes to insignificant rates. Unfortunately, this is not true. Depending on the atmospheric conditions, primary pollutants can stay in high concentrations for a relatively long period of time near to where they have been discharged. Most of the bigger particles subside in the immediate vicinity of the source of pollution. Some pollutants, however, can have an impact not only on the local environment, but on regional and global scales as well.



The chemical substances suspended in the atmosphere are considered pollutants when they are in abnormally high concentrations, which can harm human health and the environment. Common air pollutants include sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), lead, dust particles and volatile organic compounds (VOCs).

The following air pollutants are considered noxious: metals and metalloids (cadmium, mercury, arsenic), mineral fibres, dust, and asbestos (which can be inhaled), inorganic gases (chlorine, fluorides, cyanides, phosgene), organic substances (aldehydes, aromatic and polycyclic hydrocarbonhydrates, dioxins), and others.

One of the most dangerous things is the mist of dangerous gases called smog, which forms in towns with heavy traffic when the sun shines brightly and there is hardly any wind.

Most atmospheric pollutants are harmful for people's health, since they cause:

- inflammation of the eyes and of the respiratory organs;
- poisoning;
- allergies; and
- malignant or genetic mutations.

Lesson Plan: The air we can't do without

Duration	2-3 class periods
Time of year	Any
Place	The classroom
Materials	Paper, scissors and felt pens in four colours (variants: note board and chalk in four colours, or a children's mosaic consisting of buttons or pieces in various colours)
Aims	<ul style="list-style-type: none"> • To teach the basic components of the air • To explain the importance of the atmosphere for the Earth • To raise awareness that air should be kept clean
Methods	Association game, demonstration, discussion, brainstorming, dilemma solving



Part I: Air can be (Association game)

On the board, draw several balloons and ask the students to come up with words to complete the sentence: "The air can be . . ." Answers may include: clean; transparent, warm; polluted; etc.

Part II: What is in the air? (Demonstration and discussion)

1 Start the lesson by asking the students how long a person can live without air. Have several volunteers inhale deeply and hold their breath for about half a minute (as long as they can). Let them explain to the rest of the class the way they felt at the end of the experiment.

2 Tell the class about the role of the atmosphere and what the air consists of, using the information from the beginning of this chapter. Explain that you are going to create a picture, which will show what air consists of.

Variant 1: Use 104 circles cut out from paper in advance (78 yellow, 21 blue and the rest multi-coloured).

Variant 2: Use coloured chalk or a children's mosaic consisting of buttons or pieces in various colours.

Arrange the 78 yellow circles and explain that they represent the **nitrogen** in the air. The plants turn the nitrogen into solid compounds, called proteins, which are critical for other living organisms.

- Add 21 blue circles, representing the **oxygen** in the air. All plants and animals need oxygen to exist.
- Add one multi-coloured circle and explain that it represents a blend of carbon dioxide, water vapour and inert gases. **Carbon dioxide** is extremely important for the growth of plants. **Water vapour** becomes rain and snow, without which life on the Earth would be impossible.
- Explain that nitrogen, oxygen, carbon dioxide, water vapour and inert gases are the natural components of clean air. Their availability in the air is in the proportions represented by the hundred circles used so far.
- Ask all students to breathe in deeply, to hold their breath for half a minute and to breathe out. Explain that the air they have exhaled has changed its composition. They have consumed part of the oxygen in it, and they have exhaled carbon dioxide and water vapour in its place. This can be illustrated in the following way: take away three or four circles and replace them with three or four multi-coloured ones.

3 Set up a discussion:

- What would happen if we increased the number of the multi-coloured circles at the expense of the blue ones? In nature this corresponds to increasing the proportion of carbon dioxide and various other pollutants at the expense of oxygen. (You could illustrate this by taking away three or four blue circles and replacing them with three or four of various colours.)
- What air pollutants can students point out? (e.g. *smoke from industrial plant chimneys, the exhaust pipe gases from cars, smoke from fires*)
- How will people and other organisms feel if the air is polluted? When have the students been in similar situations? Encourage the children to share their stories. One example might be a room full of cigarette smoke.
- Compare these stories to experiences and feelings in relation to the air during a walk in the forest, the mountain or along the beach. Encourage students to elaborate on these.

4 Lead the students to see that all life — people, animals and plants — need clean air for good health and quality of life.



Part III: The importance of the atmosphere for the Earth (Discussion)

- 1 Ask the question: Why is air important for the Earth and the living organisms on it? Write the suggestions on the board. Complete the students' answers using the texts in the introductory part.
- 2 Describe what the Earth would be like without the atmosphere. Help the students to see that without the atmosphere the Earth would be radically changed and life would be impossible (much colder, no air to breathe, photosynthesis and burning processes made impossible, drastic climate change, no sound or smells, etc.)
- 3 Hand out the factsheet Why the Earth Needs its Atmosphere. Have the students write the answers in the boxes.

Part IV: Indoor air quality (Discussion)

- 1 Explain to the class that:
 - Very often the public's attention is focused on the purity of the air in the open, while the quality of the air indoors is underestimated or neglected. Scientists claim that sometimes the air indoors can prove to be much more polluted than outside, even in industrial cities. Moreover, people nowadays spend more time indoors. Clean air is very important for children. The volume of the air which they inhale, compared to their body weight, is bigger than that of adults. Their risk of accumulating dangerous substances in their body is therefore much greater.
 - Spending a long time in front of the TV screen or the computer monitor can have harmful side effects, and talking on mobile phones may be even worse. These activities can lead to exhaustion, headaches, eyestrain, and in more severe cases it can cause cancer, disturbances in the immune system and behaviour, as well as many other health problems.
 - For children, who are in the process of growth, the risk for such diseases is greater. Scientists suppose that the reasons for all of this are the electromagnetic waves emitted by the computer monitor or the TV screen, and they affect the mechanisms of the growth of cells. A similar health risk can be talking on mobile phones, which also emit electromagnetic waves.
- 2 Hand out copies of the fact sheet How to Protect Yourself from Electromagnetic Waves and discuss together with the children the healthy ways to use computers, televisions and mobile phones.
- 3 Mention to the students that there has been evidence, provided by the scientists, that the prolonged carrying of mobile phones by boys near the groins puts them at serious danger of reducing their fertility in the future.

Other activities

- Hand out copies of the test Do We Know Air? and have the students do it individually.
- Hand out copies of the pupil fact sheet Maintaining Healthy Air Inside Your Home on page 7 and have the students do it individually.
- Ask several volunteers to form a small group and to discuss the dilemma in The Violator in front of the others.
- Ask the students to present in drawings the importance of air and what the Earth would be like without an atmosphere. Set up an exhibition.
- Make copies of the picture on page 129 and hand them out to the students to colour in.



DILEMMA The Violator

Imagine that you are an important person in your town. One day you are driving your car and the police stop you. They test your car and find out that it is polluting the environment. They give you a ticket and say you have to pay a fine. What do you do?

- Call some people who know the mayor and tell them to cancel the ticket.
- Sell the car.
- Try to change the law so that your car is now okay.
- Pay the fine and do your best to avoid the police in the future.
- Pay the fine and have the car repaired.
- Something else.



TEST Do We Know Air?

	TRUE	FALSE
1 The atmosphere is the “warm blanket” of the planet.	<input type="checkbox"/>	<input type="checkbox"/>
2 The atmosphere is the layer around the Earth in which the weather is formed.	<input type="checkbox"/>	<input type="checkbox"/>
3 Oxygen is the most common gas in the atmosphere.	<input type="checkbox"/>	<input type="checkbox"/>
4 When we breathe, we inhale carbon dioxide.	<input type="checkbox"/>	<input type="checkbox"/>
5 The oxygen and carbon dioxide in the air are in constant rotation due to the plants and the animals.	<input type="checkbox"/>	<input type="checkbox"/>
6 Industrial plants and transport vehicles are the biggest polluters of the air.	<input type="checkbox"/>	<input type="checkbox"/>
7 The life and well-being of organisms depend on the state of the air.	<input type="checkbox"/>	<input type="checkbox"/>
8 Electromagnetic waves are completely safe for people.	<input type="checkbox"/>	<input type="checkbox"/>
9 Without air, the Earth would be a desert planet.	<input type="checkbox"/>	<input type="checkbox"/>

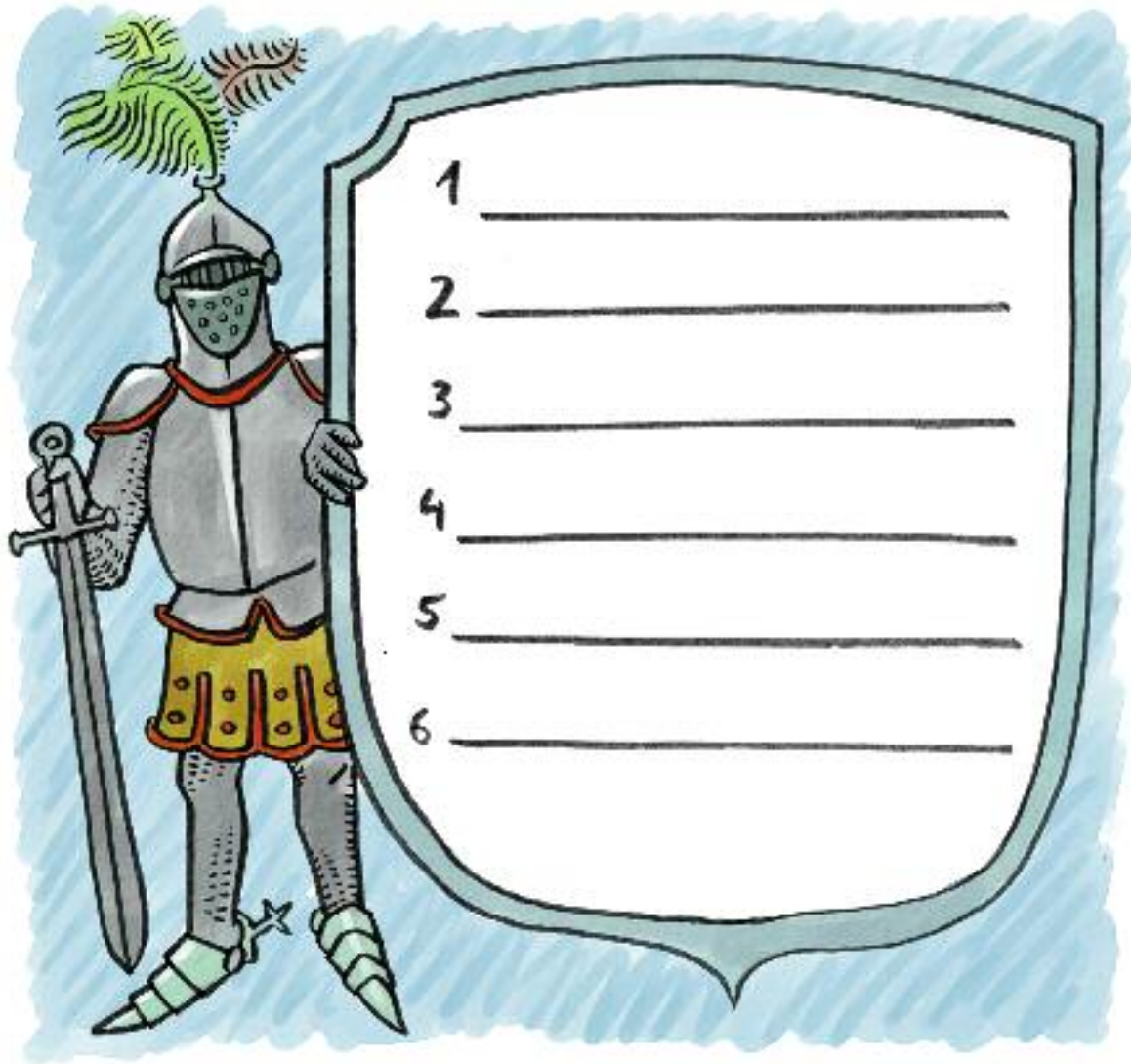
Answer key: 1. True 2. True 3. False 4. False 5. True 6. True 7. True 8. False 9. True



FACT SHEET

Why the Earth Needs its Atmosphere

Only six of the statements listed below are true about the atmosphere.
Write the correct answers on the shield.



makes our **weather and climate** possible

provides people with **natural gas**

is the media where **photosynthesis** takes place

provides people with **building materials**

plays a key role in the **water cycle**

allows **burning** to take place

makes **breathing** possible

spreads **smells and sounds**

is the **environment for all living species**



FACT SHEET

How to Protect Yourself from Electromagnetic Waves

Spending a long time indoors at home, in front of the computer or the TV and making long mobile phone calls can be dangerous for human health. Precautious and sensible attitudes are extremely important. Here are several simple ways to reduce the risks to your health:



Watch TV from at least 2 metres away.



Sit at least 50 cm from your computer monitor.



Use safe screens or protective glasses when you work on the computer.



Do not spend longer than four hours daily in front of a computer and take a ten-minute rest every half an hour.



Do not make long calls on the mobile phone and avoid using it in closed iron-concrete or metal rooms (including cars).



Regularly air the room in which you study.



Take more walks in the open.





FACT SHEET

Maintaining Healthy Air Inside Your Home



Don't smoke.



Clean and air the rooms regularly, even in winter.



Grow plants, which reduce the concentration of harmful substances in the air indoors.



Limit the use of chemicals at home.



If possible, replace wall-to-wall fixed carpets of artificial material with ones made of natural materials.



All kinds of household chemical materials should be kept in a place suitable for the purpose.