**Earth Day - Our Earth is our worth**

About our special atmosphere for everyone

The Earth's atmosphere is warming fatally. The process began as a result of carbon dioxide coming from human activity in the early 20th century. Due to the warming, the ever-frozen Arctic soil began to melt. This means a problem from the climate perspective, because the huge amount of methane, which was so far bound in the permafrost, is now released and gets into the atmosphere. Methane is an even stronger greenhouse gas than carbon dioxide...

*On our educational session organized on the occasion of Earth Day, we wanted to draw students' attention to the vulnerability of our atmosphere and the importance of reducing carbon dioxide.*

**1. Our place in the solar system**

We make a numerical scale model and information cards from the planets of the solar system. In the session, the kids have to assign the cards to the right planet.

*Our most important goal is to make them recognize and emphasize how wild and unbearable conditions prevail on the two adjacent planets for humans. What an exceptional place the Earth is!*

In the model, the Sun should be a beach ball with a minimum diameter of 40 cm or a rice lamp that can be blown with yellow paint. Then the reduction ratio will be 1: 3,500,000,000, when e.g. Mercury's diameter is 0.14 cm, the Earth's is 0.37 cm and Jupiter's is 4.1 cm.

The planets can be symbolized by beads or balls of an appropriate size. We made the stocks from salt-flour dough, so we were able to provide the right size. After drying, the spheres can be painted, which increases the value of the model, as each planet has a characteristic colour. Even small children can be asked to prepare the planets in technology (art) lessons.

The spheres are suspended as desired (racks, hooks, rods or ropes are needed) or simply stacked in a black box. The Sun is at the beginning of the line.

For each kit, we make two sets of cards to work with 6 students in groups of 3-3. The cards contain the names of the planets, their proportional distance from the sun, the number of their moons and the information about their atmosphere. (This can be found on our website.)

Children first place the name cards to the appropriate spheres. In the next step, let's look at how far the planets should be moved from the Sun in the model. We will be surprised, because for example the Earth would have 42 m and Neptune 1300 m numerical scale distance from the Sun.

Bigger children can work completely independently, the smaller ones may need more or less teacher support. Finally, we check and discuss the solutions.

We can also visit the planets if we have time: QR codes can be placed on the name cards, so children can easily open a small animation with their phones.

*How beautiful our Earth is!*

Model kits are easy to store in small boxes and can be used for several years.

**2. The thickness of the Earth's atmosphere**

We can now expand the Earth. How thick will be the layer on the surface of a school globe or a beach ball (30 cm) that is proportional to our atmosphere?

We ask for tips, children usually say 2-5-10 cm. It is instructive for the teacher to ask the children to demonstrate the thickness too, because it turns out that even bigger ones do not always have the right idea for the size of cm!

The Earth's diameter is 12740 km, and the Karman line is 100 km high. Above this the air is so rare that this height is considered as the boundary of space. Within this, the bottom layer of our atmosphere, the troposphere is only 15 km thick. 80% of the air mass is found here, every weather phenomenon and the greenhouse effect are created here. The next layer, the upper limit of the stratosphere, is 50 km away from the surface. Here's the ozone shield.

Knowing these, the bigger ones can be expected to determine the thickness of the atmosphere in the model on their own. First, the diameter of the globe model must be measured. They get two long rulers as help, with which e.g. they can set a tangent, then they can measure the distance with the tape measure. It's hard to come up with the measurement procedure, and then counting is not easy either. This task is very good for practicing straight proportionality, managing units of measurement, and developing manual skills.

For the smaller ones, of course, we will tell the result of the calculation: from the data we find that a 2.4 mm thick layer models our atmosphere on the surface of the school globe if we take 100 km as the basis.

*Let's see this layer!* The groups make 2.4 mm thick pancakes from plasticine.

Tools: plasticine, mason jar, knife, plank, tape measure

We wouldn’t think, but this is a complex task even for the bigger ones! For uniform thickness, manual tracing is not enough, we need the glass that replaces the rolling pin. Pancakes should be picked up, don't let them stick down. To measure the thickness, it is advisable to create a cutting surface, but how to keep the tape measure...?

The prepared pancakes are glued to their globe and they can wonder how thin this layer is! This thin atmosphere ensures life: the right temperature, pressure, oxygen, protection against radiation and incoming bodies.

(The data shows that the correct temperature depends on the composition of the lower 15 km. In the model it is not quite 0.4 mm!)

Let them draw the conclusion: we must take care of it!

**3. Why is it a problem if our atmosphere's carbon dioxide concentration is increasing?**

We carry out an experiment to show that carbon dioxide can heat up much more than air when exposed to the same amount of infrared radiation.

Tools and materials:

two transparent and lockable small boxes (e.g. a toothpick box, with a punctured hole for the thermometer), two thermometers (preferably a simple kitchen digital thermometer), an infrared lamp, a glass, a spoon, matches, soda (sodium carbonate), vinegar or hydrochloric acid, plasticine

The acid is poured into a glass on a spoonful of sodium carbonate. Violent effervescence starts and the cup fills up with carbon dioxide in a few seconds, because it has greater density than air, so it displaces it. With a single burning match, this can be demonstrated: the matchstick extinguishes at the mouth of the glass.

The high density but colourless and odourless gas is gently poured into one small box and sealed. There is air in the other box. The small holes are sealed with plasticine and both boxes are placed in front of the infrared lamp. After 3-4 minutes of heating, the temperature of the closed gases is measured.

The production and pouring of carbon dioxide is interesting in itself, even if the children do not meet it for the first time. The 3-4 Celsius degree temperature difference at the end of the heating is a really shocking and thought-provoking experience for everyone.

Some of the electromagnetic radiation from the Sun is absorbed by the soil, which radiates this energy back in the form of higher wavelength radiation. One part of this high-wavelength infrared radiation returns to space. The other part is absorbed and trapped by carbon dioxide (in addition to atmospheric water vapour, methane, nitrous oxide, near-surface ozone), which warms up the atmosphere. Without the greenhouse effect, instead of the current approx. 15°C, the average temperature would be -18 °C on Earth.

For thousands of years, there was 280 cm3 of CO2 in 1 m3 of air. This 280 ppm concentration created a pleasant earth climate. But an increase in concentration results in an increase in temperature. In the thin troposphere, however, a significant increase in concentration can be achieved in a short time if carbon dioxide emissions are not compensated with increased absorption. And we also cut the forests!

According to scientists the 350 ppm concentration measured in 1985 was still safe, but in recent years we have crossed the 410 ppm carbon dioxide concentration.

Too much CO2 makes the Earth too hot, the ice caps are melting releasing methane,

which makes this place even hotter…

*Personally, what can each individual do in everyday life against a further increase in carbon dioxide concentration?*

Let’s learn about the effects of atmospheric carbon dioxide, and let’s act!

**"There is no plan B because there is no planet B!"**