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INNOVATIVE STEPS

Project: Innovative STEPS (Innovative Sustainability Education for Prosperous Schools)
Project number: 2022-1-SK01-KA220-SCH-000085417

Learning Resources for Students (Workbooks and Activities)

Environmental education

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Learning Resources for Students
(Workbooks and Activities)

Environmental education

1. ECOSYSTEM

Poster Ecosystem

In the theoretical part of the lesson, students will review the problem of the ecosystem, its types and functions. In the practical part then they will create different types of their own ecosystems on a quarter with the help of paint, scissors, glue and the internet. At the end of the practice, it is appropriate for the students to present their short projects to the rest of the class. Afterwards, the class can discuss the functions of the ecosystems and their other components.

A) Introduction to the topic (max. 5 min)

An ecosystem is a general term for a system of living and non-living components of the environment that are interconnected in some way. They can vary in size, but even the smallest ones form an important component of nature. Some affect its balance.

Some ecosystems are constantly under pressure from human intervention and climate change, which can lead to their collapse or even extinction. However, nature provides vital functions for human well-being, and it is therefore very important that people pay attention to this issue and ensure the health of all ecosystems.

The following activities should make students aware of the importance of different ecosystems and make them think about their conservation.

B) ACTIVITIES OF CHOICE (10 – 14 years)

1. **Ecosystem (Theoretical part: 15 – 30 min.)**
2. **Ecosystem production (Practical part: 30 – 60 min.)**

Tools and materials:

- quarters
- watercolours/pastels
- markers
- paper
- scissors
- glue
- Internet
- printer, computer

1. Ecosystem (questions and subsequent discussion of the answers)

- Briefly write what do you mean by ecosystem?

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- What are the types of ecosystem?

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- Give at least 3 examples for each type:

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- What is the difference between living and non-living components of an ecosystem (give examples)?

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- What is the main function of the ecosystem?

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- How do we protect ecosystems? Think of at least 5 examples.

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- How do we protect ecosystems? Think of at least 5 examples.

  .....

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- What all does nature provide for humans (think of at least 3)?

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- (What is meant by the term food chain and what are its types?)

- Add arrows to the ecosystem cycle diagram (hint –- the arrows show the relationships between objects):

The Sun | Carbon Dioxide | Plants | Carnivores | Herbivores

2. Poster Ecosystem (group work)

1. Prepare all the tools

2. In groups, divide the main roles: painter, finder, editor and gluer, presenter.

Painter – his main task will be to paint the design of the poster.
Search engine – its main activity will be to search for important information on the computer.
Cutter and gluer – his task will be to cut out selected pictures and glue them on the poster. Presenter – at the end of the presentation he will present the final work of the group to the class.
The roles are intended, but whoever doesn't have something to do in their role helps others

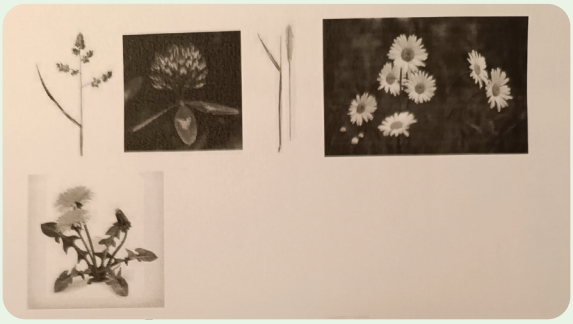
3. Choose one of the following ecosystems: meadow, forest, lake, field, pond, garden.

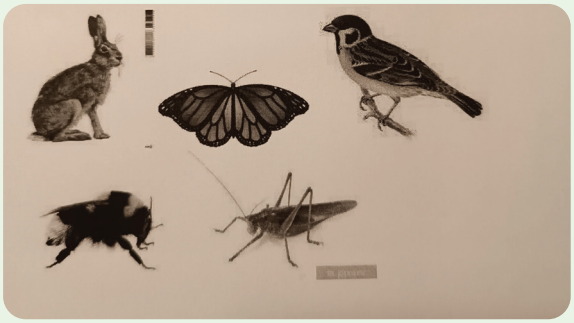
4. Start working on the poster:

The painter works on painting the design of the chosen ecosystem. He can use any colours and styles.
The search engine looks for at least 10 components that are typical of the selected ecosystem (5 animals = **fauna** and 5 plants = **flora**). He/she finds their pictures and saves them in Word document (be careful about SIZE – the pictures must fit on the poster). The others help.

5. Once the picture document is ready – ask your teacher to show it to you.

6. Once the document is printed:
the editor will start cutting out the images.



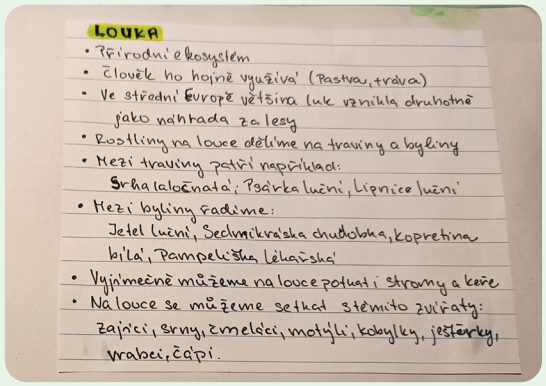


The search engine uses the Internet to search for characters typical of the selected ecosystem. And with the help of the presenter, it creates a presentation for a maximum of 5 minutes.
The presenter writes down the speech on paper.

7. The painter should have the base of the poster ready at this point.

8. The cut-out images are suitably glued onto the poster

9. The presenter and the search engine are finishing the speech. At the end, they paste the the speech on the back of the poster.



LOUKA

- Přírodní ekosystém
- Člověk ho hojně využívá (pastva, tráva)
- Ve střední Evropě většina luk vznikla druhotně jako náhrada za lesy
- Rostliny na louce dělíme na traviny a byliny
- Mezi traviny patří například: Srha laločnatá, Psárka luční, Lipnice luční
- Mezi byliny řadíme: Jetel luční, Sedmikráska chudobka, kopretina bílá, Pampeliška lékařská
- Výjimečně můžeme na louce potkat i stromy a keře
- Na louce se můžeme setkat těmito zvířaty: zajíci, srny, čmeláci, motýli, koblylky, ještěrky, vrabci, čápi.

10. Once the other groups are done, all presenters present their poster in front of the board.

REMEMBER!

An ecosystem is a functional system of living and non-living environmental components that interact in space and time. Ecosystems are divided into two types - natural (those that have evolved on their own without human intervention) and artificial (those that have been created by human intervention). Ecosystems can vary in size, but even the smallest ones are an important component of nature and must be protected and cared for.

Nature provides indispensable services to humans, such as food, clean air and water, nutrient cycling, fertile soils and climate regulation. Unfortunately, in the last few decades, biodiversity has been lost due to human activity. Protecting the environment is one of the most important ingredients for maintaining functioning ecosystems, and therefore we need to focus on restoring and growing them. This can be achieved by establishing protected areas and national parks and, last but not least, by not polluting nature.

2. NATURAL RESOURCES

Renewable, non-renewable and sustainable sources of electricity generation

A) Introduction to the topic (max. 10 min)

We often hear around us the topics of **energy sources**, especially where to get electricity in accordance with nature.

If we look around, we see a lot of equipment that runs on electricity. Do we need to run the washing machine at home fill up the petrol tank at the petrol station, pay at the shop with a credit card? These are just a minimal number of examples of what we need electricity for. Let‘s face it, we depend on it and without its power we would be back a few centuries.

- If we want to continue to enjoy the benefits of the scientific and technological revolution and modern technology, we cannot do without electricity.
- **Electricity consumption** is increasing despite the increasing efficiency of appliances, but where can we get it in the quantities we need and in harmony with nature?
- We may eventually replace old cars with combustion engines with electric cars, but where will we get the ex-tremic increase in electricity consumption?

There could be many more questions about electricity production, but where is the electricity produced? I‘m sure everyone knows, but will that be enough? And how will this **production** be in harmony with nature? Yes today we have solutions that already work in harmony with nature.

Let‘s take a look together at what options we have and how to navigate their advantages and disadvantages. We use different types of power plants to generate electricity:

- Coal-fired power plants
- Gas power plants
- Nuclear power plants
- Hydroelectric power plants
- Photovoltaic power plants
- Wind power plants

You are probably all familiar with these power plants and they are somewhere in your area. We certainly have other power stations, such as wave, tidal, geothermal, etc., but do we use them here? We don‘t.

With regard to nature, renewable sources are the best for us, that is to say, power plants that make use of nature‘s inexhaustible resources.

Nuclear power plants are something of a specialty nowadays. Basically, it is the splitting of atoms, which releases a considerable amount of heat energy. It is not a renewable source of energy, but it still has many advantages and considerable power. At present, it is the only technology that is capable of providing sufficient electricity for our homes, industry and possibly even electromobility, and it produces no harmful gases, only a limited amount of nuclear waste.

B) SELECTIVE ACTIVITIES (10 – 15 years)

Activity 1:

Use of electricity (10 min)

What you need:

✓ blackboard – possibly alternative with a similar meaning, writing utensils.

Task:

Look around you and try to name all the devices that are powered by electricity? Try to record your ideas on the board, there will be lots of them, try just twenty examples, some will be similar. These can be not only devices connected to a 230 V socket, but also small electrical appliances.

Don‘t worry, you don‘t have to describe the whole board, but when you‘re done, try to think about each example, how would you replace it without using electricity?

REMEMBER!

Remember all the electrical appliances listed and their importance.

Activity 2:

Types of power plants (25 min)

What you need:

- ✓ board - possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone)
- ✓ suitable sheets of paper to create the drawing
- ✓ crayons

Task:

Let's now think together and name which power plants are renewable and which are not. We can use the list given in the introductory chapter, or we can help ourselves by looking it up on the Internet.

To explain the difference between nature-friendly power plants and power plants that pollute the environment, we can divide them into renewable and non-renewable power plants. Renewable power plants are those that harness natural energy that can be reused, more precisely, it is an inexhaustible natural force.

Once you have the power stations divided, choose one type each and use crayons to draw a picture of it according to your own ideas.

REMEMBER!

Remember the basic classification of power plants with regard to their environmental impact.

Activity 3:

Types of power plants (25 min)

What you need:

- ✓ board – possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone).

Task:

- Renewable ways of generating electricity (list): ...
- Non-renewable ways of generating electricity (list): ...

How do renewable and non-renewable power plants differ from each other? Think about (or search on the internet) what source is the „driving force" of a particular power plant.

For each power plant, try to describe its advantages and disadvantages: ...

In the following table, write down the characteristics you found:

Sources of electricity	Species – write down:	Benefits:	Disadvantages:
Renewable:			
Non-renewable:			

REMEMBER!

Remember the characteristics of each power plant.

Activity 4:

Environmental characteristics of power plants (20 min)

What you need:

- ✓ board – possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone)

Task:

Try to name what waste and in what quantity is produced by a nuclear power plant. Compare your findings with a coal or gas-fired power plant (search the internet for the necessary information).

In the following table, write down the information you found about the waste:

Waste	A nuclear power plant:	Gas power plant:	Coal-fired power plant:

REMEMBER!

Remember the waste produced by each type of power plant and its impact on the environment.

Activity 5:

School trip - excursion (5 min – discussion of the topic of the trip)

What you need:

- ✓ data projector
- ✓ digital maps, or a computing device with internet access (PC, tablet, phone) for pupils.
  According to the subsequent realization of the appropriate transport.

An idea for a school trip:

If you are interested, you can try to find any power plant in your area and try to arrange a professional excursion.

Methodological guidelines

Activity 1: Individual contributions of pupils in class, the teacher gradually lets the pupils write their contributions on the board. The teacher assists the pupils with appropriate help. The teacher guides the pupils‘ debate.

Activity 2: Individual contributions of pupils in class, the teacher helps pupils with appropriate clues and guides the pupils‘ debate. She then organizes individual drawing of a picture, which pupils can then decorate the classroom with.

Activity 3: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate writing of arguments in the table.

Activity 4: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate writing of arguments in the table.

Activity 5: Through guided discussion, students find a suitable place for a thematic excursion. The subsequent solution is according to the school‘s possibilities.

Core competencies:

Group work will develop key competences, especially social and communication competences. Furthermore, according to the specific task, there will be development of digital competence, imagination, ability to analyse text and critical thinking.

3. OUTDOOR RESEARCH – RESEARCH ACTIVITY PLAN

Rainwater retention tool, Water retention in nature, Rainfall measurement

A) Introduction to the topic (max. 5 min)

In this activity, pupils learn to measure the amount of rainfall falling on the surface of the ground at their school or home using simple rain gauges made from PET bottles, try processing the measured data and calculations with them in a spreadsheet on a computer, and keep a digital meteorological diary tracking temperature, air pressure and measured rainfall over the school year. From the measured data, the students find out framework requirements for building a simple rain catchment device to water the school garden and create a school pond.

REMEMBER!

- Water is a fundamental prerequisite for life on our planet. Human-induced significant deterioration in the ability of landscapes **to retain rainwater** and climate change in terms of uneven temporal distribution of rainfall with long dry spells and high rainfall events in a short period of time are potentially the biggest environmental problems of today, affecting food production and availability for part of the world‘s population.
- In the case of water, we have the štěs⍰⍰ that its molecules cannot leave the Earth‘s atmosphere. It is a closed system that is powered by energy coming from outside the Earth‘s system in the form of electromagnetic radiation from our nearest star, the Sun. It is called the **water cycle** and its part si e **vaporation of water** associated with capillary phenomena and photosynthesis taking place in plants, all meteorological phenomena including wind, condensation of water in clouds, **rainfall and snowfall**, thunderstorms, lightning, etc. When water hits the earth‘s surface, it then forms rivers, lakes and seas by the gravity force of water in liquid form, percolates into the soil, where it is stored in limited quantities as groundwater and reaches the roots of plants, which form organic matter from water, carbon dioxide and nutrients in the soil when supplied with electromagnetic radiation from the sun.

REMEMBER!

- However, there is one slight hitch. When man‘s intensive farming reduces the **soil‘s ability to hold water** and alters the landscape so that rainfall just runs quickly down the rivers to the oceans, plants are unable to extract the necessary amount of water from the water cycle for the biosphere to function, and otherwise life-giving sunlight mercilessly kills them. Drought will gradually turn a previously fertile landscape into an uninhabitable desert. These processes are irreversible according to current scientific knowledge. Yet humans have been aware of the importance of water for their lives for thousands of years and have been retaining rainwater for irrigation since ancient Babylon.

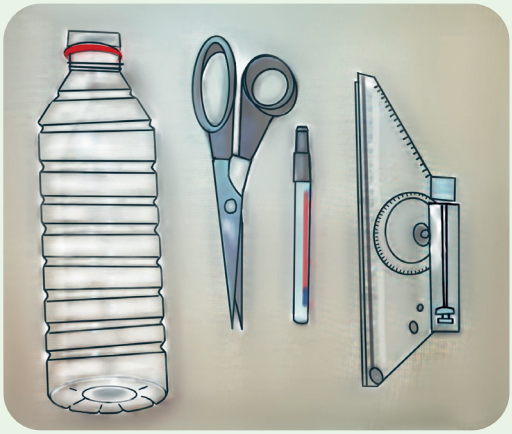
B) ACTIVITIES OF CHOICE (12 – 14 years)

Activity 1:

Rainfall measurement and capture (Theoretical part 20 – 30 min, Practical part 60 min)

What you need:

- ✓ Rain PET bottles, sharp scissors, a paring knife (be careful it is very sharp), rulers, tailor's tape measures, tape measures, graduated cylinders, kitchen or laboratory scales, slats or sticks;
- ✓ Optional: school measuring system with force meter, weighing module, temperature sensor (thermistor or thermocouple)



In this activity, the pupils learn to measure the amount of rainfall falling on the surface of the earth in the school and in their homes using simple rain gauges made of PET bottles, try processing the measured data and calculations with them in a spreadsheet on a PC, and together keep a digital meteorological diary tracking the temperature, air pressure and measured rainfall over the school year. From the measured data, the pupils find out frame the requirements for the construction of a single rainwater harvesting device for watering the school garden and the creation of a school pond. This is the beginning of a long-term group project where it is important to monitor rainfall for at least one to two months.

a Theoretical part (20 – 30 min)

Name the different types of precipitation by their composition.

.....

Name the categories of precipitation according to their precipitation and compare them with the professional names found on the Internet. In the tře⍰⍰ho column of the table, add the amount of precipitation according to a trusted Internet source of information.

.....	.....	..... millimetres per hour
.....	.....	..... mm/h
.....	.....	..... mm/h
.....	.....	..... mm/h
.....	.....	..... mm/h

(Hint: drizzle, shower, rain, downpour, thunderstorm)

Recall or look up on the internet the formula for calculating the circumference of a circle.

.....

Remember or look up the formula for calculating the area of a circle on the internet.

.....

Recall or look up on the internet the formula for calculating the volume of a cylinder.

.....

Recall or look up the formula for calculating density on the internet and find the value for the density of water.

.....

Make a list of different containers for liquids and (in a table) write down their shape, dimensions and volume.

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b Practical part (60 min)

Rain gauge made of PET-bottle

You can use any container such as a bucket, cup, glass, mug or cut PET bottle to measure rainfall. The measurement area is always determined by the neck of the container. Therefore, containers with vertical side walls are suitable and, conversely, containers tapering towards their neck are unsuitable.

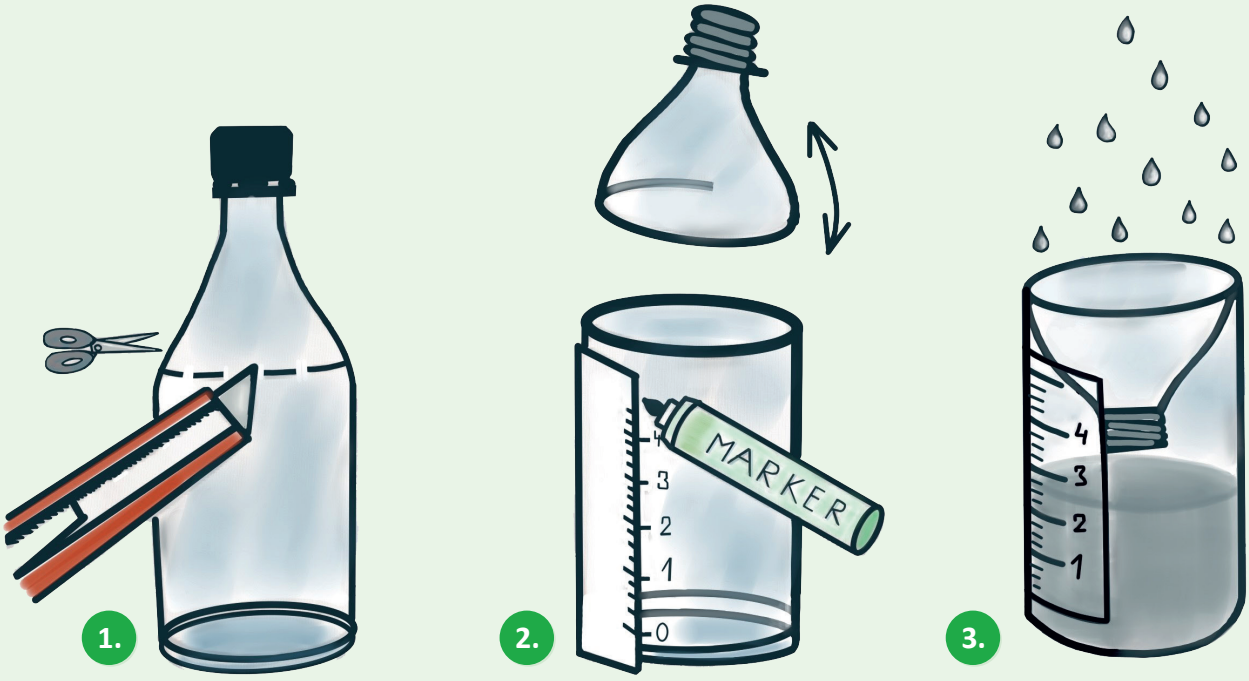
During the measurement, a portion of the captured water evaporates from its free surface. How can the effect of this phenomenon be minimized?

Use the cut-off part of the PET bottle as a funnel. Insert the cut-off top of the bottle into the bottom of the bottle with the cap threaded downwards, thus obtaining a precipitation catching surface area many times larger than the size of the bottle neck opening and at the same time reducing evaporation from a large part of the free surface of the liquid.

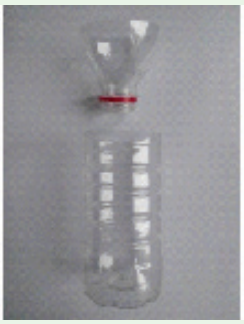
Workflow

1. Prepare all the necessary tools on your workbench. Cylindrical PET bottles with a volume of 1.0 to 2.0 litres and vertical walls at the bottom of the bottle are suitable.

2. Cut off the part of the PET-rope where it starts to taper. Turn the cut part of the bottle with the thread facing downwards and insert into the cylindrical base without gluing. If you have worked accurately, it will hold after insertion by frictional force only.







3. Measure the diameter of the PET-boat directly with a ruler and calculate the area of the precipitation meter on a PC in Lib- reOffice Calc. This method of measuring the diameter of the PET-boat is laden by significant systematic error.

4. Therefore, measure the circumference of the cylindrical part of the PET-boat at three different heights and calculate the area of the collision by substituting the radius thus obtained from the modified formula for the circumference of the circle into the formula for the content of the circle. Which method is more accurate?

5. The PET bottle does not have a flat bottom. Before measuring a small amount of rainfall, the measuring container can be filled with enough water so that the level is zero in the area where the PET bottle is cylindrical. However, do not fill it with water yet.

6. Now the rain gauges need to be tagged. Stick a millimetre scale on the side of the PET-boat, for example a thin flexible ruler or a millimetre scale printed on a laser scanner notransparent film (Meotar film). If you have neither, a scale made with non-washable alcohol marker in 5 mm increments will also suffice.

   The second possibility is to mark the rain gauge in volumetric units using a laboratory graduated cylinder and then convert to the height of the water column in the cylindrical measuring vessel. The spreadsheet editor LibreOffice Calc is also a good tool for this.

7. Place several rain gauges on school property. You can also take measurements at home in the garden or outdoors, for example in a park or field outside the city. Mark the spot with a laminated sign and check it regularly to ensure that no one thinks it is littering and removes the rain gauge.

8. When taking measurements, place the rain gauge in an open area on a horizontal pad. The measurement area must not be covered by branches or be too close to buildings, walls or fences. All of these could affect the measurement in wind conditions. In the open air, secure the rain gauge against flipping over by sticking a few sticks or branches around it.

9. Create a group meteorological diary for school measurements and your own meteorological diary for daily measurements. It used to be a paper notebook. Today it is more like a notebook in Libre-Office Calc. In the spreadsheet, record the date and time, air temperature, air pressure, and the measured water column height in the rain gauge (or precipitation volume). You can measure the air pressure data using a weather station, a school measurement system, or by checking the current weather forecast.

10. Determine the intervals at which you will enter data into the table, i.e. at what intervals you will measure the level in the measuring vessel. This is called the sampling frequency or sampling rate. Under normal conditions, it is sufficient to record a reading of 1 time per day, 1 time per hour for heavy rainfall, or 10 minutes for shorter showers, or record the total amount of rainfall for a given event. For example, X mm of rain fell this afternoon during 47 minutes of rain, or Y ml.

11. From the daily data, use the LibreOffice Calc spreadsheet to calculate the rainfall for one week, for the whole month and finally (if you can keep measuring long enough) the annual rainfall.

12. Convert the mm of rainfall in the cylindrical container to the volume of rainwater in millilitres. What is the volume of water in a PET bottle that represents a 1 mm increase in level at 20 °C in the approximately cylindrical part of the bottle?

13. Compare results from different measuring vessels and measurements at other locations. How do they differ? What might be the reasons?
    Discuss. Discard the results with gross error and calculate the mean values from the relevant results for each location.

14. Calculate, knowing the floor plan of the school building, the volume of rainwater discharged from the roof of the school annually into the storm sewer. What is the value of this volume of water at current water and sewerage rates?

15. Instead of measuring the water level in a cylindrical container, you can weigh the container using a precision kitchen or laboratory scale and calculate the volume of the liquid by knowing the density of the water.

16. The task can be optionally automatized and the force values can be recorded every 10 minutes or even every minute. Hang the measuring container on the force gauge and measure the volume of water indirectly via the weight (or applied gravity force) of the water in the container, which gradually fills with water as it rains.

    WARNING: *The force gauge module, the supply wires to the force gauge module and the measuring interface must be protected against rainwater. Suggest how to achieve this.*

Core competencies:
At the end of the chapter, go back over the individual actions with the students and have them summarize the specific knowledge and skill gains in their own words using the questions, „What new things did you learn from building the rain gauges? Which concepts did you remember? Which procedures were new to you? Which activities did you enjoy?“

The students can reflect on the learning process in a group orally or in a notebook in writing in individual struggles and then hand it in to the teacher. Similarly, a digital whiteboard or even an ordinary whiteboard can be used for pupils to write down their thoughts in a quick brainstorming session.

An idea for a long-term project.

Would you like to explore this topic in more detail? Then you will appreciate the suggestions for these two actions, which are more time-consuming but very useful.

Garden shed with guttering and barrels

What you need:: buckets, barrels, hoses, hose connectors, plastic pipes, aluminium gutters, aluminium gutter fittings, gutter mounting brackets, riveting pliers, battens, screws, tape measures

School garden pond (biotope)

Materials: plastic sheeting or large sturdy garbage bags, rounded stones, water plants, garden tools (shovel, hoe, pick, garden wheel)

4. DIFFERENT TYPES OF PLASTICS AND THEIR PROPERTIES

The game Tic-Tac-Toe

A) INTRODUCTION TO THE TOPIC

The treatment of **residual plastic materials** is one of the key components in the waste recycling hierarchy. At the same time, it is also related to the waste of other resources. For further processing of plastics, it is necessary to know their properties, which can be derived from the originally produced objects and at the same time according to their groups, i.e. it is necessary to know their **labels**.

By combining recycling and **saving other resources**, new interesting products are created that maintain real activity of pupils and lead to versatile skills as well. Creating new products from residual (waste) materials demonstrates recycling in practice at an individual level with available resources.

However, a key factor that has a major impact on plastic waste pollution is the reduction in the production of plastic products and packaging materials. Recycling and reuse of plastics must be addressed secondarily, as it is more difficult to cover the ever-increasing amount of plastic waste generated rather than to reduce its quantity in the context of production.

B) ACTIVITIES OF CHOICE (9 – 11 years)

1. **Marking and use of plastics (theoretical part 15 min)**
2. **The game of tic-tac-toe (practical part 30 min.)**

What you need, materials used:

- plastic bottle (PET)
- plastic lids 6 pcs. and more
- scissors
- coloured/white paper or A4 quarter 1pc
- black alcohol based marker
- crayons
- markers or watercolours
- Eurofoils 1pc
- ruler
- crimping knife

1. Marking and use of plastics

Safer plastics

Each plastic has its own special mark, do you know what to find under each number? Talk to your classmates, try to list the types of plastic materials and under each label.

Plastics to avoid

Look around the classroom to see if you can spot them on any products. Write each product together with its label.

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Did you know that recycling plastics produces other different plastic materials that may not look like the landbased ones? Try looking up what is made from recycled plastics.

Write down the individual labels and what is made from their recyclates. A picture can also help.

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Imagine you have 20 plastic caps in front of you. Try to think of all the things you could make with them or what they could be used for when you no longer return them to the bottle. Try to figure out different modifications to plastic materials for use in f.ex. heat sources.

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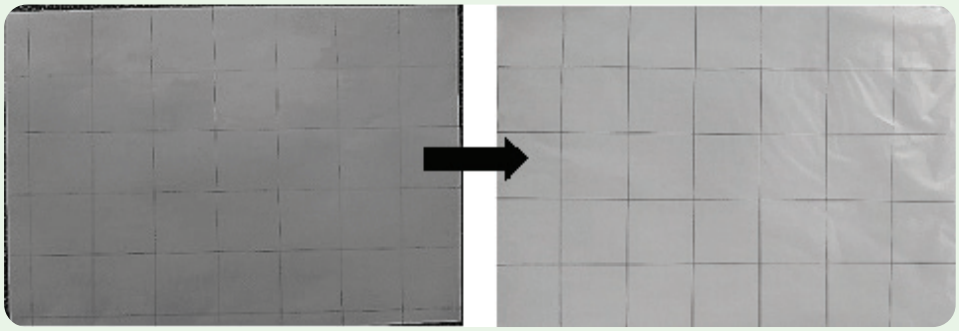
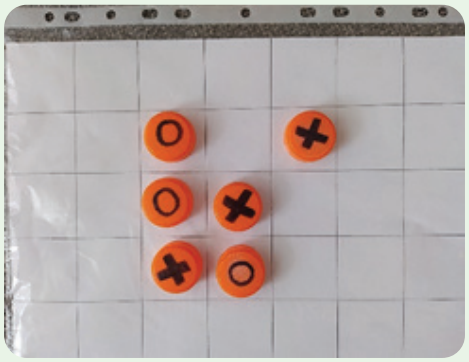
2. Game of Tic-tac-toe

1. Make a square grid on white paper size A4. The squares are 4 × 4 cm. Cut off the excess strips, highlight the square grid and put it in foil.



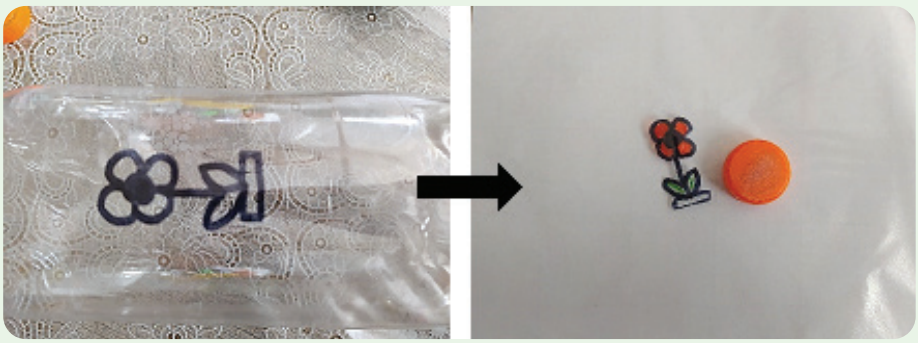
2. After inserting the square net into the eurofoil, we get a playing area. Pupils can decorate this area as they wish.

3. Use the plastic caps as game pieces. The simplest way to mark the lids is to label them on the top with the characters typical for this game, crosses and circles, both in the same amount.

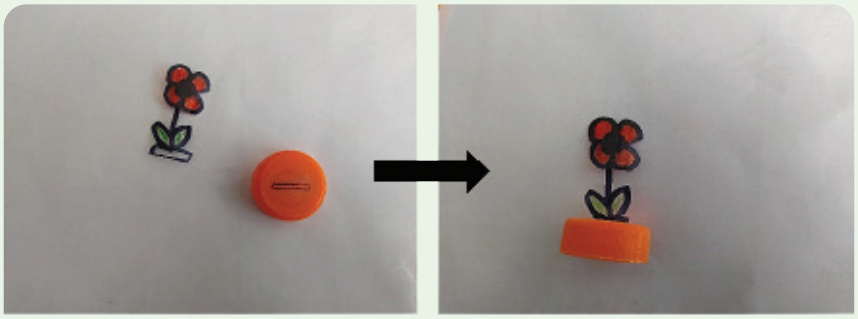


4. The figures can be further decorated in various styles, for example with use of other residual plastic materials.

4a We use an old plastic bottle, on which we paint any pattern, including the bottom handle, and cut out or colour it.



4b Cut a line approximately 2 cm long into the plastic cap to insert the chosen pattern. New unique multi-dimensional pieces are created.



5. The Eurofoil is also used to store game pieces, and prevents their loss. At he same time, we can create as many game pieces as we want for multiple players.

REMEMBER!

We produce various types of everyday products, tools and packaging materials from plastics. We encounter plastics every day, for example in toys, electrical packaging and food preservation packaging. Each plastic has a different designation, this designation determines not only its internal chemical composition but also its properties. Plastics can be recycled to a certain extent, but only to a limited extent; when recycled, plastics degrade (lose their original properties). This is why recycled plastics are often used to make different products. If recycling is inefficient for some reason, it can be used as a source of heat (electricity) in incineration. The key to reducing plastic pollution is to reduce their production.

Core competencies

During the implementation of the project, pupils will primarily develop the key competence of work. They will practise working with tools, instruments and equipment, observe the rules for work safety and practise working according to the work procedure. Various complications may arise during production, so pupils can indirectly develop their problem-solving competence. In the theoretical part, pupils will then develop their digital competence by searching for information on different types of plastics. If they work together in groups, they will also develop the key competence of communication. The content of the project itself develops the key competences of citizenship in the context of understanding basic ecological context and environmental issues.

Methodological guidelines

The time estimate for the activity is 45 minutes. The theoretical part should take about 15 minutes and the practical part the rest of the lesson. In the theoretical part it is possible to use internet resources in group work followed by verification of the information. The time needed to create the Tic-Tac-Toe may vary, also in relation to the chosen level. It will depend on the creativity and skills of the pupils, and possibly their innovation. Safety at work when handling sharp tools is also important here. At the end of the activity, it is advisable to have a discussion with the pupils on the topic, including a check of the worksheets together with a demonstration of the products. For testing, including checking and discussion, I recommend rather two lessons.

In the theoretical part, it is not so important that the pupils answer everything correctly, but that they become familiar with the terms and concepts and try to be creatively involved in inventing possible types of other products. At the same time, they should also be aware of the nature of recycling, both in theory and in practice, it is not only about recycling but also about conserving other resources that are commonly used in this activity, which could be said to be wasted, namely paper.

In the workflow you can also omit the paper itself and draw the square grid directly on the foil, we recommend using a permanent marker and a harder foil for this procedure. At the same time, the creation of the game pieces is left to the students‘ creativity. The simplest possible principle is indicated in the workflow, but pupils are free to improve the game pieces and the square grid as they wish. The activity is modified in the way that even weaker pupils can master it and more able pupils can modify it to suit themselves.

The advantage of this activity lies in its simplicity and the possibility of various adaptations with using other possible materials. When using drawing aids, alcohol based permanent markers are preferable.

Multiple games of a similar type for multiplayerss can be made on this chosen principle. For example, *Ludo, Checkers or Chess*.

5. HOW TO PROTECT THE ENVIRONMENT?

Environmental actions at the individual level

In the theoretical part of the course, students will review the basic concepts of ecology and learn the principles of environmental protection at the individual and community level. In the practical part they will learn to calculate their ecological footprint, identify which human activities are most damaging to the environment, they find out what the **energy intensity of household operation** depends on, the energy intensity of personal transport and production processes, the different modes of freight transport and storage of goods, and how to improve their efficiency. At the end, students propose their solutions to current problems of civilization, present them in a group and discuss them together.

A) Introduction to the topic (max. 5 min)

Man's behaviour naturally shapes the world around him and thus shapes the environment of his species. This includes the construction and operation of human dwellings, the production of food, clothing and other goods, transport infrastructure and everything that contributes to a comfortable life. In the long term, however, it is proving unsustainable to simply draw on fundamentally limited natural resources without thinking, turning them into waste after rapid consumption and releasing often highly toxic emissions into the air from the production and transport of new and new goods. Existing generations, for now, are only passing this pressing problem on, and with the accelerating rate of consumption, the time available natural resources will be sufficient to sustain the lifestyle we are used to is getting shorter and shorter.

B) ACTIVITIES OF CHOICE (13 – 15 years)

What you need and materials:

Computers, tablets or mobile phones with internet connection, printer, DIN A4 size sheets of paper, large format wrapping paper or DIN A0/A1 sheets, writing utensils, paper glue, glue for leather and rubber, scales, waste materials such as PET bottles with lids and others according to the specific activity.

Activity 1: „Our Customer, Our Master“ or what the consumer can change in a market economy (45 min)

Packaging materials, shelf life, storage and transport of food

Look around you and try to name all the devices that are powered by electricity? Try to record your ideas on the board, there will be many, try just twenty e x a m p l e s , some will be similar. This can be more than just When shopping with your parents, note what goods they buy and then fill in the table at home with the different types of goods, especially different foods, and study the information on their packaging. Collect the empty washed packaging, sort it by material, find out the weight by weighing it, write down the information you need and use the packaging for creative projects or take it to the recycling bin.

Food type, packaging material, shelf life, weight of contents, weight of packaging, distance

.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km
.....	.....	.....	..... g	..... g	..... km

Consider empty food packaging and record the data in a table. If you do not want to unpack the product yet, calculate the weight of the packaging from the weight difference of the whole product and the weight of the contents. Quickly return chilled and frozen foods to the refrigerator. Record the data in a table and compare them with each other.

Using a spreadsheet editor on your computer, calculate the weight ratio of the contents of the food to the weight of its packaging. For which food does the packaging weigh the most?

From the food packaging, find out the shelf life of the food in the packaging and the storage conditions. Which foods have the longest shelf life? Why?

.....

.....

In which packages do foods have a long shelf life and why?

.....

.....

Transport of goods

Find out from the food packaging where the food comes from and use maps on the internet (e.g. Google Maps) to find out the distance between the place of production and your home. Write the figures in a table.

Circle which foods were produced locally within 50 km of the city. Which are from the Czech Republic and which were imported from abroad? Which item on the shopping list was produced farthest away?

The next time you buy, check whether there is a regional alternative for food imported from far away.

Waste diary

How much plastic, paper, glass and metal packaging do you recycle per week?

Paper	Artificial matter	Glass	Tin cans	Beverage cans
..... g	..... g	..... g	..... g	..... g

What is the above packaging made of? What is the primary raw material for production?

....

Which packaging materials are sustainable? Please circle.
What can empty packaging be used for?

.....

Which food packaging is recyclable and in which container or waste receptacle does it belong?

Blue	Yellow	Green	Brown	Black (remaining municipal waste)
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

Find out on the internet how much energy is needed to produce 1 kg of paper, 1 kg of plastic, 1 kg of steel and 1 kg of aluminium sheet.

Paper	Plastics	Glass	Steel sheet	Aluminium sheet
..... kJ	..... kJ	..... kJ	..... kJ	..... kJ

Find out on the internet how much carbon dioxide is produced in the production of 1 kg of the above materials.

..... g ..... g ..... g ..... g ..... g

Activity 2: Let's try to fix it (45 min)

Direct recycling in practice

Some products wear out with use and need to be either replaced or repaired. For example, did you know that shoe soles used to be repaired? Nowadays we mostly buy new shoes.

Which products wear out and how long do they last?

Product	Duration of use	Method of repair
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

DIY-Project:

Try repairing the worn out sole of the shoe (most often at the heel) with a slice of rubber obtained from a worn out cyclic tire (otherwise also discardable) before discarding. First, ask for the help of an adult, because it is necessary to remove the wooden reinforcement of the cyclocase with pliers and a sharp folding knife. Then you can proceed on your own. Cut out the necessary size slices of rubber from the flat centre of the tread or from the sidewall of the tyre with a pair of tin snips. Clean and lightly roughen the sole of the shoe with sandpaper, apply rubber adhesive to the sole and the patch of the cycloplast, press the patch firmly after setting the adhesive and pull it off with a parts clamp. Allow the glue to set and dry ideally by the next day. Use several strips of tread for a larger area. Highly worn wide mountain bike tyre treads are ideal. One worn cycloplast is sufficient for the sole area of one pair of shoes. You can get a large sheet of rubber for the entire sole from a car tire either from its smooth sidewall or after removing the metal reinforcement from the tread with the remaining tread pattern.

ATTENTION:

Automotive tyres must be cut with a sharp tool. In this case, ask an adult for help. Never cut a tyre yourself. You can only work safely with the resulting rubber sheet.

Activity 3: „Don‘t throw away, exchange, donate“ (45 min)

Direct recycling in practice

Internet exchanges (15 min)
Search the internet for advertisements to exchange and donate goods that are no longer needed. You can find them in the internet search engine under the keywords „don‘t throw away“, „donate“, „for removal“ and also on social network. Maybe someone is just about to throw something away that you need, and a small gift of a sweet will make them happy.

What have you found on the internet and where?	**Distance**
.....	..... km
.....	..... km
.....	..... km
.....	..... km

School Exchange and Flea Market (minimum 35 min. for class, 1-2 lessons per school)
Organize a classroom auction of things you no longer need. First, ask your parents if you can donate or exchange the item. Write the names of the items on cards and post notices on the classroom bulletin board telling who is going to throw what away (offer, „I‘m offering“) and what they are looking for (inquiry, „I‘m looking for“).

Donate (e.g. old laptop without HDD or mobile phone)

.....

.....

I‘ll trade (e.g. an L for an XL, a kit for 2 apples, etc.)

.....

.....

Organise a classroom or school-wide fair, like a flea market, where others can see and try things out. The categories of the game are „donate“ or „exchange“. In this game you cannot exchange the item for money, only for another item or for fruit. Unhealthy sweets do not belong in school.

Some things nobody wants anymore, but they can be used for spare parts or for experimenting, playing and understanding the function of devices and then taken to the recycling yard according to the recycling policy.

ATTENTION:
Never open or disassemble electrical appliances with a power supply inside. There is a risk of electric shock. Even with the unit disconnected, the capacitors are still charged!

REMEMBER!

You don't have to throw every item you no longer need in the bin. Many products can be repaired, donated or repurposed. So even a broken item can still bring joy and knowledge.

Activity 4: „My house, my castle" or the energy demands of the household (45 min)

In addition to industrial production and transport, energy demands of households make a significant component of the total energy required for the functioning of human society. Find out how much energy your household needs to run. Use a spreadsheet editor to calculate.

Electrical apparatus

From the electricity supplier's bill, find out the average monthly and total annual electricity consumption of the household. Compare the data with each other in the classroom.

…… Wh per month …….. Wh per year

Use your apartment or house meter to find out what your household's average daily and weekly electricity consumption is. Use a spreadsheet editor to calculate.

…… Wh per day …….. Wh per week

Use wattmeters, so-called measuring sockets, to find out the power consumption of individual appliances in the home. Compare the data with each other in the classroom.

Instrument	Power input	Time of using in hours per day	Electrical energy consumed
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh

Household heating

Find out the monthly and annual consumption of heat or gas from the bills of the heat supplier (district heating from the heating plant) or gas supplier. Cooking on a gas cooker can be neglected in relation to the gas consumption for heating. If you heat with wood, find out how much wood, pellets or coal you need for the season and the calorific value of the fuels used. Compare the figures with each other in the classroom.

With gas heating, you can see your gas consumption almost in real time on the gas meter. Enter the meter readings at regular intervals (e.g. every day at 8 p.m.) into a spreadsheet and calculate your weekly gas consumption.

Reduce the temperature setting on the thermostats by 1°C and repeat the gas consumption readings for one week. What did you find?

Activity 5: „To work and to travel, we'll go around the world" (45 min)

By car, by plane, by boat, by train?

Look up your family car's fuel consumption on the internet.
How many kilometres a week does your family car(s) travel?

Find the CO emissions data2 for the fuel type used
(petrol, oil, LPG). Convert using the spreadsheet editor.
the amount of fuel burned per amount of carbon dioxide produced.

…… km pre week …….. litres per week …….. g CO_2 per week

How many people are riding in the vehicle at one time? What is the balance per person?

…… persons …….. g CO_2 per week per person

Find out on the internet what is the average fuel consumption of a train or bus journey, what is the number of passengers and what is the resulting energy consumption and CO2 per person using public transport. Compare and discuss in a group the values found with the result of the calculation for the passenger car.

Automobile:	…… g CO_2 per km	…… CO_2 per person per week
Bus:	…… g CO_2 per km	…… CO_2 per person per week
Train:	…… g CO_2 per km	…… CO_2 per person per week

You are going on a holiday to Croatia and you are deciding whether to go by car, train, fly by plane or part of the way by ferry.

Use maps on the internet to find out the distance from your location and home to your destination by road, rail and as the crow flies.

…… km by road …….. km by rail …….. km by air

Calculate the amount of fuel (or more generally energy) needed to cover this distance by different means of transport. Consider a flight on a large aircraft with full capacity and a fully occupied train. Report the consumption per number of passengers on a relative basis. Compare car and bus.

…….. on the road by car

…….. by road by bus, …….. by rail …….. by air

Find out on the Internet the amount of carbon dioxide produced by burning petrol, oil, aviation petrol and energy mix in production of electricity in Europe.

…….. g CO_2 on the road by car

…….. g CO_2 by road by bus, …….. g CO_2 by rail …….. g CO_2 by air

Key competences

Working in a group, pupils develop social skills. Working independently and in groups, they develop problem solving skills, information retrieval and orientation in large amounts of data, information sorting, analytical and critical thinking.

At the end of the lesson, the students will realize how much waste is produced in food production. They will also learn what to do with the waste produced. They will also learn how not to create new waste by repairing materials and recycling used items.

By thinking critically while monitoring the amount of energy consumed, they will find ways to save energy.

By tracking the carbon footprint of their domestic car, they will realise that using other modes of transport, such as cycling or walking, will reduce their carbon footprint.

Methodological guidelines

The time estimate for these activities is one to two lessons (45 minutes). Students work autonomously in groups under the supervision of the teacher according to the tasks and guiding questions. It is possible to divide the class into groups, with each group solving part of the whole lesson and then presenting their findings to the class.

6. SORTING AND RECYCLING

Waste treatment

If we want to get the pupils excited about the topic, they can take their own open fridge at home.

During the first, theoretical part, the pupils clarify the breadth of the problem of waste sorting by means of a questionnaire and practical examples from their own environment. They will see what bins can be found in their neighbourhood and use the Recycling Bins in the UK activity to realise the differences in different countries.

To conclude the theoretical part, it should be emphasized that the ideal is not to create waste, but to recycle or upcycle it. In the practical part of the activity, the pupils take on the role of an extreme minimalist. At the end, they will try to create a simple product in groups (ideally in pairs) using commonly available recyclable materials. They will present this product and together they evaluate the idea and its design.

A) Introduction to the topic (max. 5 min)

Wastes can be classified according to various criteria: origin, composition, degree of hazard, etc. For the purpose of this project we will be interested in the division according to the recoverability. Recycling of waste materials should be part of our daily routine.

Waste management is a matter that can be influenced by the behaviour of each individual. One Czech produces more than half a tonne of municipal waste per year, according to data for 2021. We need to spread awareness of good waste management and adopt the **3Rs (Reuse, Refuse, Recycle)** rule, which aims to reduce the amount of **municipal waste**. Reuse – reuse what can be reused and don‘t buy new. Refuse - let‘s learn to refuse, let‘s not be tempted to buy things that are unnecessary or inappropriately packaged. Recycle – let‘s recycle, let‘s sort properly.

In the modern world, the emphasis is on **minimalism and upcycling**. Upcycling is the process of repurposing unused products or waste materials and finding for them new use. Often it is designused art. Particularly with light metals (cans, tins) this trend is welcomed and there are many ways how to make decorations and practical home or garden accessories.

REMEMBER!

The primary goal of man is not to produce waste and in the case of waste already produced, solutions must be implemented to reuse it využi□□ through recycling/upcycling and overall reduction.

B) ACTIVITIES OF CHOICE (12 years)

Tools and materials:

✓ For the warm-up activity we will need: a photo of the fridge with the contents, crayons.

For the practical part we will need the materials listed for each activity, it depends on your own choice of project.

The other actions are without aids and use only the waste materials listed.

Activity 1: Warm-up activity – My fridge (theoretical part with home preparation 10 – 15 min)

In the photo you can see (your) fridge. Can you find the different types of waste materials? Write them down and colour them with the colour of the container you would throw them in.

.....

.....

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Activity 2: I sort, you sort, we sort – discussion + game (theoretical part 10 min; questionnaire 10 min)

...do they also sort?

You must have noticed the containers around you at school, at home, in your neighbourhood. But have you noticed that some places (e.g. abroad) sort waste differently? What caught your eye?

You can take notes during the discussion with others.

.....

.....

.....

.....

.....

Try to check your knowledge of sorting in England.

Play INSTEP. If you're surprised by anything, write it down.

.....

.....

What is the situation in our area? Let's vote and work together. (1 person can write the number of votes and write back to make a certain statistics).

1) Do you sort your waste?
   a) Absolutely.
   b) Occasionally.
   c) I don't sort.

2) If you don't sort your waste, why?
   a) The containers are far away.
   b) Containers are missing.
   c) The containers are full.
   d) I'm lazy/I'm too lazy to sort
   e) It doesn't make sense.

3) Are you sure where the waste material belongs?
   a) 100% yes.
   b) Mostly, yes.
   c) Rarely.
   d) I don't know.

4) If you are not sure how to sort the waste
   a) You try reading the packaging.
   b) You ask someone.
   c) You find out elsewhere (e.g. internet...)
   d) Dispose of the packaging in mixed waste.

5) Do you understand the sorting information on the packaging?
   a) Yes.
   b) Sometimes.
   c) I don‘t understand.
   d) I didn‘t even know it said that

6) Do you know how to use sorted waste?
   a) Yes.
   b) A little bit.
   c) I can‘t think of anything.
   d) I don‘t care. I have

7) What waste do you sort?
   a) Paper.
   b) Plastics – just bottles.
   c) Plastics.
   d) Glass.
   e) Electronic devices.
   f) Bio-waste.
   g) Other:

8) Do you know where your nearest can container is?
   a) Yes.
   b) I think so.
   c) I don‘t know.

9) How do you manage bio-waste?
   a) I don‘t sort bio-waste.
   b) We take them to the collection yard.
   c) We have compost.
   d) I sort into the bio-waste bin
   e) We feed animals with it.

Space for comments:
.....
.....
.....

Activity 3: Optional, long-term project

Moon in a basket (practical part full of various activities promoting inter-subject relations)

Here you will find tips for project-type activities and their possible inclusion in other ssubjects to strengthen cross-curricular relations.

1. Moon in the paper basket
Pupils are asked to organise a paper collection competition. The whole school can take part, the competition is held in teams (classes or groups), they should make rules about what does/does not belong in the collection, how it will be handed over, stored, what the deadlines will be, how the evaluation will take place and if there will be any reward for the winner. Finally, they must not forget to arrange redemption or other use the paper.

This activity promotes collaboration, organisation and critical thinking. During the evaluation, they will use one-way math and they find out in practice how paper collecting works..

2. Moon on the sheet
Cans and preserves are often an overlooked item in waste sorting. Talk to your pupils about where the nearest metal waste container is, what Iron Sunday is and what waste belongs in metal (clean yoghurt lids, metal caps, aluminium cans and tins, etc.) and what belongs elsewhere (spray cans belong in hazardous waste, coloured coins in the collection yard, etc.).

If you can arrange for pupils to bring cans and tins to school, you can then carry out all sorts of experiments in the classroom.

Music lesson – Make your own drum set
You will need: different sized cans with the lid removed, an inflatable balloon for each of them, scissors and chopsticks as drumsticks (you can also play with your fingers or make chopsticks out of paper). Cut the balloon and pull it as tightly as possible over the open part of the can or tin. Use chopsticks or your fingers to drum and compare the sounds of different sized „drums“.

Physics – Experiment

Give the students a few minutes with their mobile phones or PCs to look up experiments with the skin. Students can report back and explain what is implosion, atmospheric pressure, dissolving aluminium using the waste counter, experiments with gallium, balancing a can on a glass, rolling a can using electrostatic force, etc. If you are equipped to do so at school, you can set up and perform any of the experiments safely.

Physical education – Olympics on the sheet metal

Discuss with students the problem of doping, read the ingredients of an energy drink or non-/alcoholic beer in a can. Have an unconventional Olympics with different stations using cans/canned food.

Possible stations:
squats with a can on the head
skittles (cans + paper ball) throw the can into the distance
building a can tower relay race with a can
long jump (measuring with cans) hitting a can with a pebble
basketball
There are no limits to your imagination, just be careful that there are no sharp or cutting edges on the cans/tins.

3. Moon in plastic

Just take a look at the composition of your wardrobe - especially the labels and materials. Acrylic, elastane, polyamide, polyester, latex... synthetic fibres from petroleum. Let's talk about where we encounter plastic in everything and try to figure out how it can be upcycled.

What products could be made from plastics generated in your home?

- Sample handbag made of plastic strips
- Sample of plastic earrings

4. Moon in decay

This event focuses on bio-waste and the construction of a home composter. The detailed procedure can be found in chapter 7.

If you organize one of the „in the bin" months, we recommend dedicating a bulletin board in your school to this project and gradually adding information/photos/articles/passwords/links. We believe that the project could be of interest not only to the class that will be the main organizer of the event.

Activity 4: Minimalist – game (15 min)

Divide the class into two teams. They can be againts each other or always pairs against each other. It is about practising giving arguments, critical thinking and especially being aware of how much packaging and waste we create in a typical day.

S1 and S2 in the example denote Student1 and Student2, or the whole team of students.
S1 starts by telling about his daily routine, S2 interrupts him with critical questions, which S1 tries to answer in a way that saves the environment and minimizes the generation of waste materials.

S1: I get up in the morning and make tea for the whole family.

S2: So every day you throw a paper and a black tea bag in the trash, actually 4 of them, because everyone gets a cup of tea?

S1: Hm. No, I can get up and make a whole pot. Or I can use dried mint from the summer and it won‘t make any extra fallout, and then I‘ll throw the leaves in the composter.

S2: Excellent. Let‘s move on.

S1: I‘ll have a roll with butter and ham for breakfast.

S2: But that means you bought a roll in a bag, and after the ham there‘s a plastic box left over.

S1: No...

REMEMBER!

The European Union aims to reduce waste materials and emissions and uses various laws to do so. Every individual can help the environment by sorting waste correctly. The primary objective is to avoid waste and, in the case of waste already produced, to implement solutions for its reuse through recycling/upcycling and overall reduction (3Rs: Refuse, Reuse, Recycle).

7. BIOWASTE

Simple composter

A) Introduction to the topic (max. 5 min)

Bio-waste is the abbreviated name for **biodegradable** waste. It is organic residues from our gardens. Bio--waste makes up around 40% of the weight of all waste thrown away and often ends up in the communal waste stream rather than in the brown bins that are designed for it.

From the point of view of the circular economy, bio-waste is a very promising material that could be used as a fertiliser or even an energy source (e.g. electricity, gas). First and foremost, however, we need to focus on its proper sorting and composting.

Bio-waste can be composted in a **vermicomposter** using earthworms, in a conventional compost in the garden or in a shared compost with neighbours. These places and brown bins are always a better option than municipal waste, incinerator or landfill, which produce greenhouse gases due to the lack of air.

B) ACTIVITIES OF CHOICE (11 – 14 years)

Materials (in pairs/groups):

- 1 two-litre plastic bottle, scissors or extendable pruning knife, rubber band, alumini foil (larger than the diameter of the bottle body), sharp pencil or skewer, container with soil, container for scooping soil, bio-waste in a cup (food scraps, leaves, etc.) and the object with which we will scoop the waste, water spray and newspaper.

Activity 1: Bio-waste and its sorting (Theoretical part 15 min)

When taking this quiz, only 1 answer is always the most appropriate.

- What colour is the container for sorting biodegradable waste?
  A) Green
  B) blue
  C) brown
  D) Black

- Approximately what percentage of total waste is bio-waste in the Czech Republic (EU)?
  A) 5 %
  B) 20 %
  C) 40 %
  D) 55 %

- How much of the food grown or produced in the world is not consumed and thrown away?
  A) 1/4
  B) 1/3
  C) 1/2
  D) everything is consumed

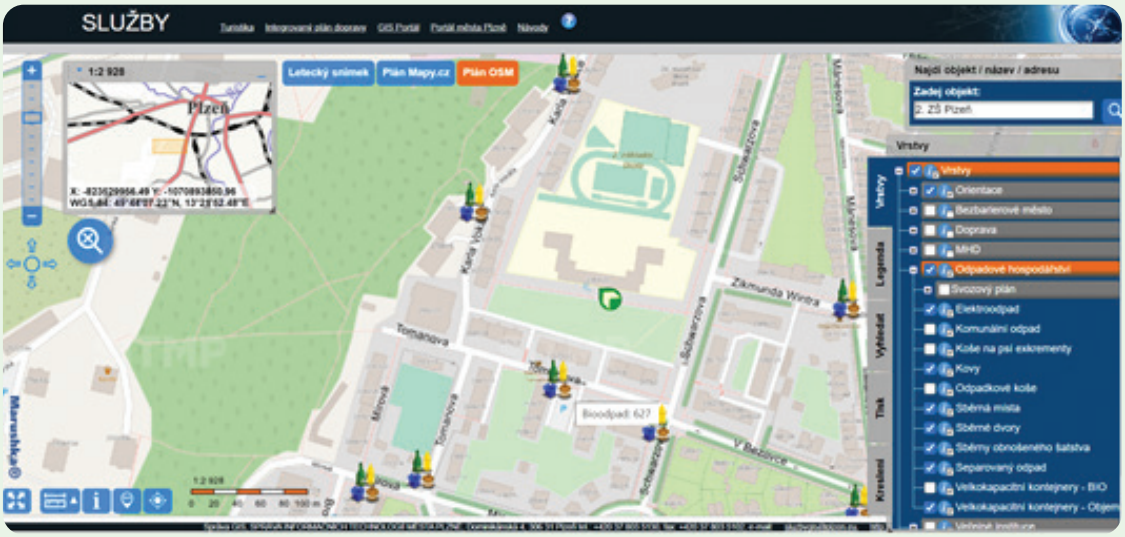
- Which of the following is the ideal situation for bio-waste?
  A) Do not produce waste.
  B) Sort waste.
  C) Compost the waste.
  D) Take the waste to the landfill.

- What does the vermicomposter use?
  A) water
  B) earthworms
  C) flowers
  D) special chemistry

- The main advantage of compost is that it is free from landfill is the elimination of greenhouse gases. Which ones?
  A) Oxygen
  B) nitrogen
  C) Methane
  D) Butane

Activity 2: Brainstorming – bio-waste here and now (30 min.)

1. In groups or pairs, draw as many waste bins as possible around where you are. You can then check the picture using an internet map of waste management and discuss the availability or unavailability of individual containers, especially bio-waste bins.



2. Think about today's snack. What could go in our composter? Discuss how it works in your home, kitchen, garden. What does/doesn't belong in the bio-waste.

3. In groups or pairs, determine which waste belongs to into which waste receptacle.

Activity 3: Making a simple composter (practical part 30 min)

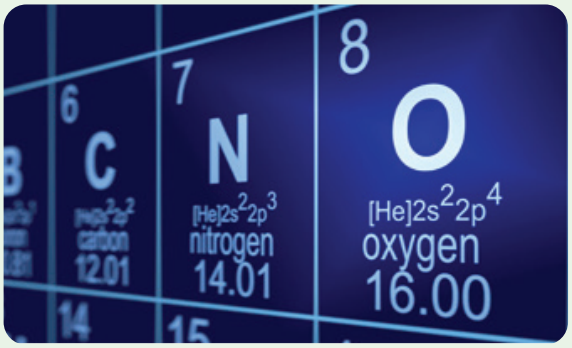
1. You can watch a sample video in English and follow it.
   Add this link: *https://raabe.digital/composter/*

2. Cover the work area with newspaper and prepare all the necessary materials for the group.

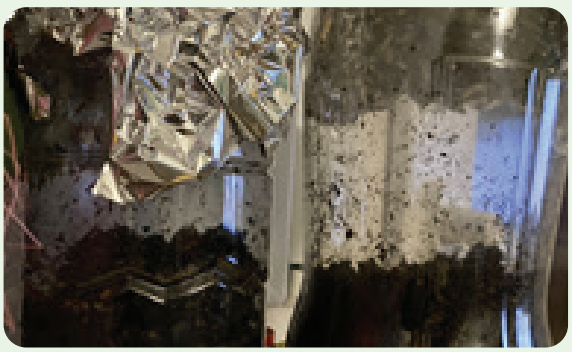
3. Stand the bottle up and cut off the neck and throw it away in the sorted waste, or use the cap to make a Jojo toy (see other activities). We will be left with a small home composter.

4. Pour a layer of soil into the composter, then add some bio-waste and spray it with water. If we added too much water, decomposition would not take place and the smell would start to spread. In this case, we add more soil or pieces of newspaper to the compost. If the mixture is too dry, just splash a little water on it.

5. We mix the mixture in the bottle, emphasising the difference between compost and landfill, where no one aerates the evaporated material. In the composter, oxygen-breathing bacteria can survive and decompose the waste without producing methane.



6. Finally, we close the composter bottle with aluminium foil, which we pull over the lid and secure with a rubber band with the help of the team. Punch small holes in the lid with a sharp pencil to allow oxygen to get in. As long as we have not added any unsuitable waste (plastics, meat, etc.), the composter should not smell.



Activity 4: Cross-curricular activities (approx. 15 min each)

Art Education – Describe paintings by famous artists and comment with respect to the theme.

Title: Vertumnus
Author: Giuseppe Arcimboldo
1591, Praha

Zdroj: https://en.wikipedia.org/wiki/Vertumnus#/media/File:Vertumnus_%C3%A5rstidernas_gud_m%C3%A5lad_av_Giuseppe_Arcimboldo_1591_-_Skoklosters_slott_-_91503.jpg

English language – The video is in English, present your own composter and describe how you proceeded, what you needed.

Find a *What Not to Include in Biodegradable Waste at* https://wordwall.net/resource/74226607

Math – Try playing around with a calculator and calculating your carbon footprint to track the possible changes if you change your own behaviour and focus more on sorting and recycling. For example, the GreenOmeter website can help.

Chemistry – Project on Greenhouse gases. What are they and how do they work?

REMEMBER!

Bio-waste is biodegradable waste. It is in society's interest to focus on its separation and use composters, vermicomposters or brown bins. Why do we not want bio-waste to end up in landfill? Because it would decompose there without access to air. Greenhouse gases (methane) would be released, odours would be created and the decomposition process would take longer. Another fact is the volume of landfill growing.

Organic waste of plant origin (fruit and vegetable peelings, leaves) belongs in the compost, while animal waste (meat, bones), oils, nappies, etc. have no place in bio-waste.

8. WASTE HIERARCHY, RECYCLING AND REUSE

Waste Hierarchy, Recycling and Reuse

A) Introduction to the topic (max. 5 min)

The waste hierarchy is a key aspect of waste management. If its principles are followed, it will lead to a reduction in the overall production of waste in society.

The creation of new products from waste materials then demonstrates **recycling** practice at an individual level.

B) ACTIVITIES OF CHOICE (9 – 11 years)

1. **Hierarchy of waste**
2. **Lid Jojo**

Tools and materials:

- plastic caps 2pcs
- skewers 1pc
- cotton
- hot melt gun
- scissors
- nail scissors
- wooden beads 2pcs
- coloured paper or quarter 1pc

1. Hierarchy of waste

In the picture you see **"The Waste Hierarchy"**. Can you explain what the term means?

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You must have noticed that the concepts in the pyramid are shuffled, can you sort them correctly?

Discuss with a classmate what each term means. Write at least a small note on each one.

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Look carefully at the following workflow. What principle from the pyramid is used in it? Remember to justify why.

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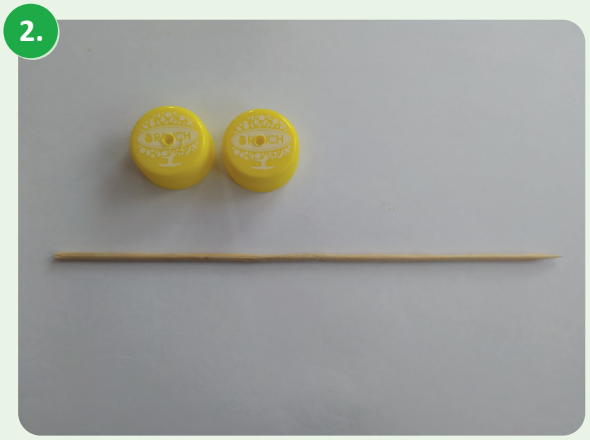
2. Lid Jojo

1.

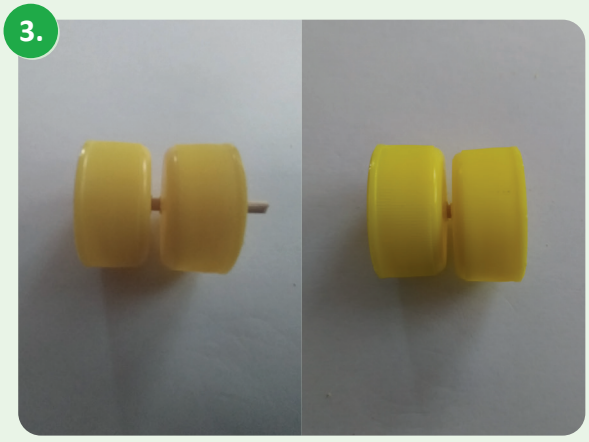
Prepare all the necessary materials and a melt gun.

2.



Using nail scissors, make a hole in the centre of each plastic cap the diameter of the width of the skewer.

3.



Place the lids as close together as possible, threads apart. Push a skewer through them, so that it doesn't extend through the side of the cap. Trim the end of the skewer on the other side.

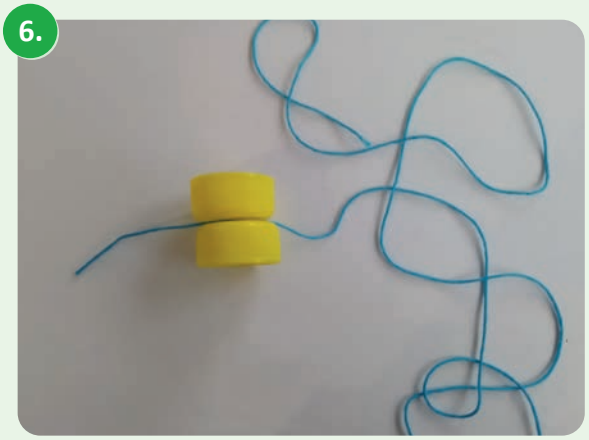
4.

Fix the skewer on the threaded side with a melting gun to prevent the lids from moving and slipping.

5.

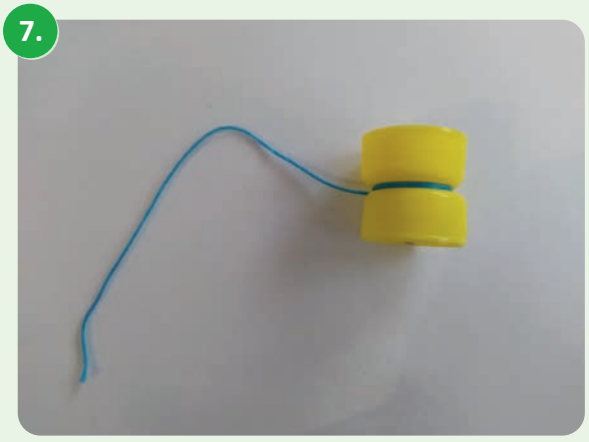
Prepare a piece of cotton from which you cut a piece approximately 15 cm long.

6.



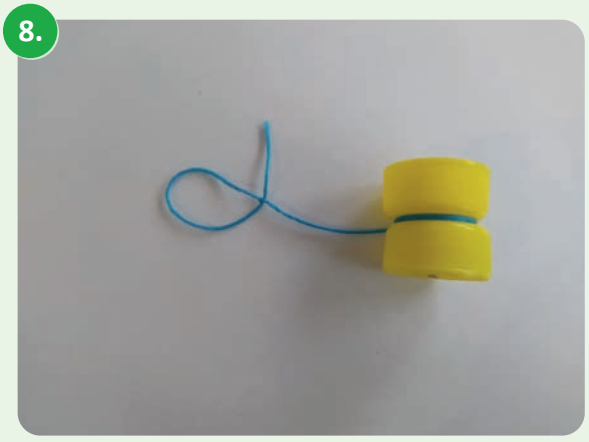
Make a stitch at the end of one side of the cotton, thread it on the middle of the skewer between the eyelids and knot it with one knot.

7.



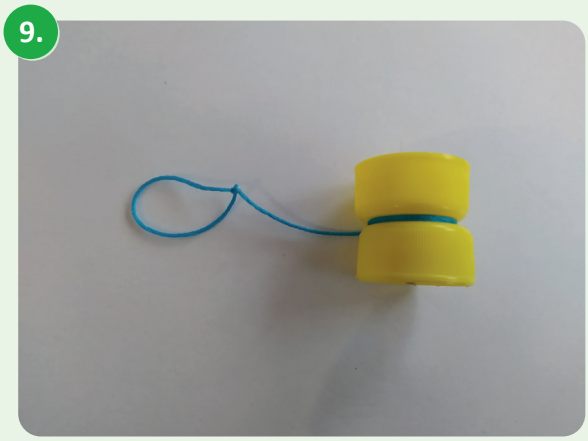
Cut off the shorter part of the excess cotton and wrap the rest of the cotton tightly on a skewer between the lids.

8.



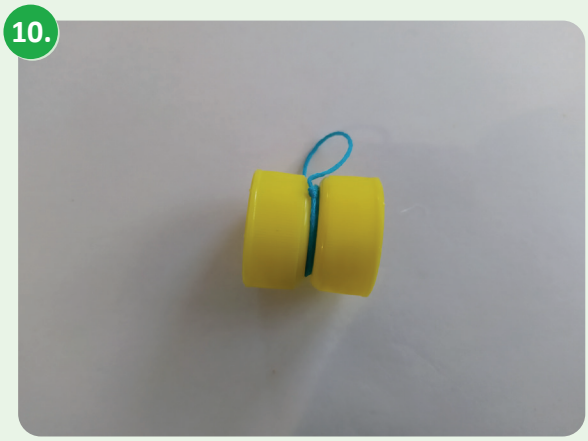
Make a loop at the end of the thread, so that you can put it on your finger and handle the Jojo.

9.



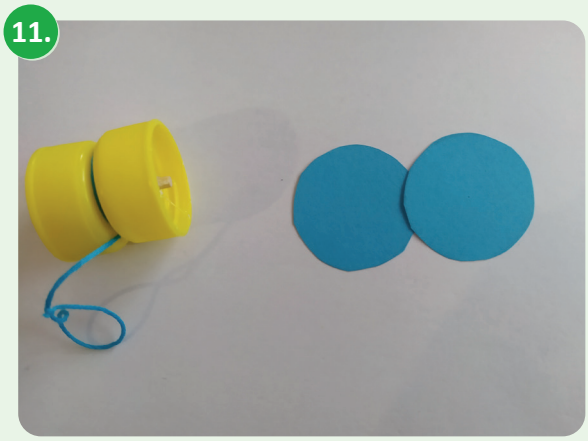
Trim the excess cotton at the stitch so that the knot is not broken.

10.



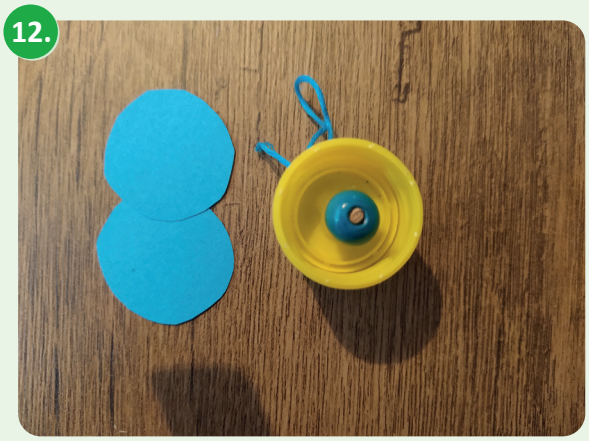
Wrap the rest of the cotton over the formed JoJo.

11.



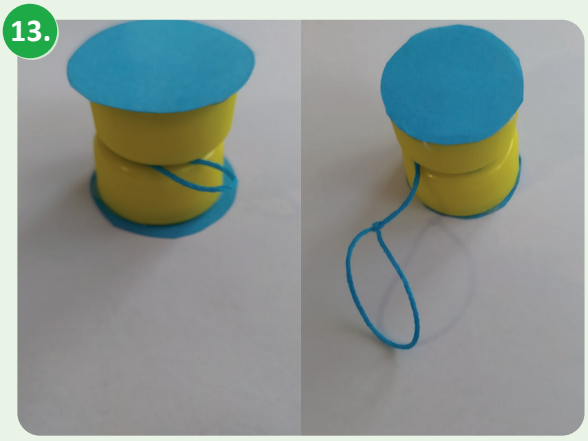
Prepare coloured paper or coloured quarter from which you cut out two circles.

12.



Use two wooden beads and attach them to the sides of the lids on the protruding skewers.

13.



Quickly glue the cut out wheels to the sides of the lid with a hot glue gun so that the yoke closes at the threads. Trim the paper overlaps.

14.

The yo-yo is balanced and closed on the sides, after drying the glue is ready for use. It can be decorated with colours or symbols.

REMEMBER!

A well-applied waste management hierarchy has a positive impact on the reduction of waste generation, ensuring conditions for its reuse and recycling. It determines the possibility of other (e.g. energy) waste and addresses its eventual disposal. The effective managing of these principles has a positive impact on the environment and the amount of waste.

9. BUSINESS FROM AN ECOLOGICAL PERSPECTIVE

A map of the business world from an ecological perspective

A) Introduction to the topic (max. 5 MIN)

In view of current trends, there is increasing pressure for **green business** – so-called green entrepreneurship. This is particularly the case in Europe, North America and some countries in Asia. This type of business is intended to create a concept for an ideally zero environmental burden. At the same time, green business also incorporates social influences into its concept, thus trying to contribute to economic and social development in the world.

There are several ways to survey the environmental performance of countries around the world, and thus to identify those countries that have the biggest and also the smallest environmental business problems. However, it is important to recognise the crisis situation in some countries and its subsequent impact on the environment.

The following activities are intended to shed light on the importance of green entrepreneurship and at the same time introduce students to rreal data.

Activity 1: Doing business in the world from an ecological point of view (theoretical part, homework, 30 m)

What you need: question sheets, paper, pen, computers, markers, paints, worksheets

1) Divide into 6 groups.
2) Choose a continent (North America, South America, Europe, Asia, Australia, Africa).
3) Divide the questions in the group (separately or in pairs).
4) Using the computer, answer the questions (at home). Do not forget to cite your sources.

Questions:

North America:

1) What can we say about green business in Alaska? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products originating from this country and evaluate whether they are green or not.

2) What can we say about green business in Canada? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and agree whether they are green or not.

3) What can we say about green business in the United States? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

4) What can we say about green business in Mexico? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

5) What can we say about green business in Greenland? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

6) Record important historical events in Asia that have affected the environment and green business.

South America:

1) Record important historical events in South America that have affected the environment and, by extension, green business.

2) What can we say about green business in the northern part of South America (Colombia, Venezuela, Guyana)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

3) What can we say about green business in the eastern part of South America (Brazil, Paraguay, Uruguay)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

4) What can we say about green business in the western part of South America (Ecuador, Peru, Bolivia)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

5) What can we say about green entrepreneurship in the southern part of South America (Argentine, Chile)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

Europe:

1) What can we say about the green business in Western European countries (France, Germany, the United Kingdom)? Do they have any laws on green business? List some brands from these countries that you can trust to be eco. In contrast, list some brands that claim to be green but are not and why (hint – look at Unile-ver). What do these logos mean? Look for information on the internet.

2) What can we say about green business in the Czech Republic? Do we have any laws or amendments that regulate green business? List some brands that you can trust to be organic. Conversely, list a few brands that claim to be organic but really are not and why.

3) What can we say about green business in the northern European countries (Finland, Norway, Sweden)? Do they have any laws on green business? List some brands from these countries that you can trust to be green. Conversely, list a few brands that present themselves as green but are not and why (hint: look up Ikea and Romania).

4) What can we say about green business in Eastern European countries (Bulgaria, Romania, Ukraine, ...)? Do they have any laws on green business and do they follow them? List some brands from those countries and evaluate whether they are green or not.

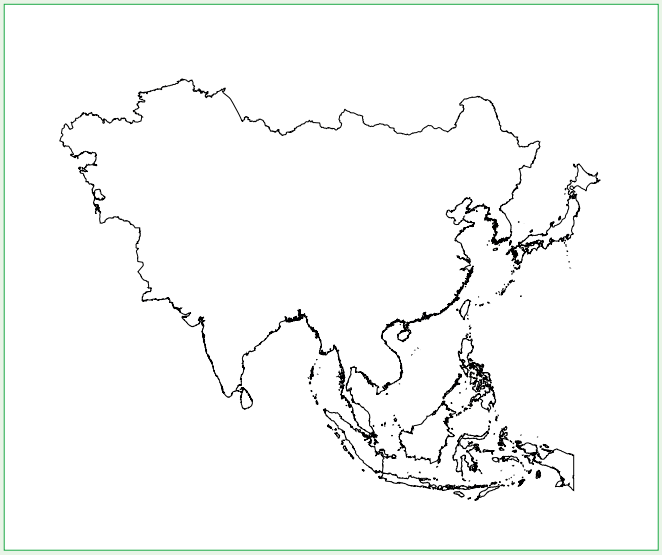
5) Record important historical events in Europe that have affected the environment and possibly green business (hint: look at the topic Industrial Revolutions).

6) What can you tell us about NESTLÉ's green business? Is it really green in every way? Where does the brand come from and what is its history?

Asia:

1 What can we say about green business in Russia? Do they have any laws on green business and do they follow them? List some brands from this country and agree whether they are green or not.

2) What can we say about green business in China? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/statements coming from this country and evaluate whether they are green or not.



3) What can we say about green business in West Asia (Turkey, Iran, Saudi Arabia, ...)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate if they are green.

4) What can we say about green business in India? Do they have any laws on green business and do they follow them? What is the socio-economic climate there and how is the environment affected because of it? List some brands/products coming from this country and evaluate whether they are eco-friendly.

5) What can we say about green business in East Asian countries (Japan, Korea)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate their environmental friendliness.

6) What can we say about green entrepreneurship in Southwest Asian countries (Thailand, Vietnam, Laos)? Do they have any green business laws and do they follow them? What is the socio-economic climate in these countries and how does it affect the environment? List some brands/products from these countries and evaluate whether they are environmentally friendly.

7) Record important historical events in Asia that have affected the environment and green business.

Australia and Oceania:

1) What can we say about green business in Australia? Do they have any green business laws and do they follow them? What is the socio-eco- nomic climate there and how is the environment affected as a result? List some brands/products from this country and agree whether they are green.

2) What can we say about green business in New Zealand? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products that come from this country and assess whether they are green.

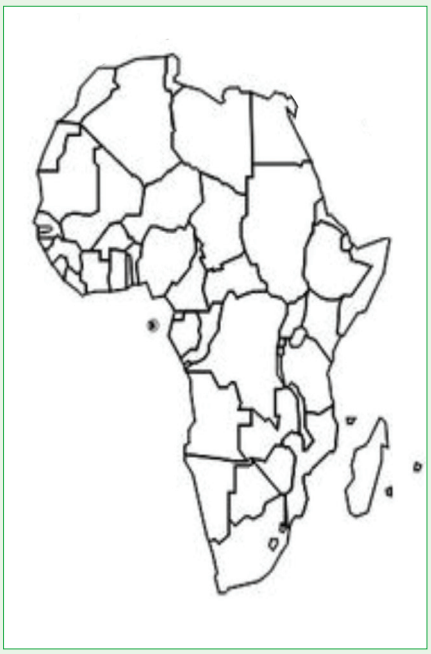
3) What can we say about green business in Micronesia? Do they have any laws on green business and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate if they are green.

4) What can we say about green business in Melanesia? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

5) What can we say about green business in Polynesia? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

6) Record important historical events in Australia and Oceania that have affected the environment and, by extension, green business.

Africa:



1) Record the important historical events in Africa that have affected the environment and green business.

2) What can we say about green business in West Africa (Sudan, Ethiopia, Somalia, Kenya, ...)? Do they have any laws about green business and do they follow them? What is the socio-economic climate there and how is the environment affected as a result?

3) What can we say about green business in North Africa (Morocco, Algeria, Tunisia, Egypt, ...)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

4) What can we say about green business in Southern Africa (Angola, Zambia, South Africa, ...)? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate whether they are green.

5) What can we say about green business in East Africa (Mali, Senegal, Ivory Coast, ...)? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products coming f r o m these countries and evaluate whether they are green.

Activity 2: Elaboration of knowledge about continents, production of continents map (Practical part – 40 min)

What you need: elaborated worksheets, map of continents, markers

1) Get into the same groups as in action one.
2) Discuss your answers to the questions you have been working on.
3) Write down your thoughts (the most important things you have learned) on the continent map.
4) Select one presenter.
5) Present your findings to the rest of the class.
6) With all the groups together, create a world map.

REMEMBER!

Eco-friendly business, also known as green business, is not only a trend of our time, but is also very important for maintaining a healthy environment and is therefore crucial for a better future. Green entrepreneurship is a concept to reduce environmental burdens. This means that it seeks to ensure that business has a minimal, ideally zero, impact on the environment.

One of the main tasks of green business is to reduce production waste and harmful emissions. At the same time, however, it is also concerned with the impact on people. This means that it seeks to contribute to social and economic development and the creation of good working conditions. The green economy seeks to change the current linear economy into a circular economy.

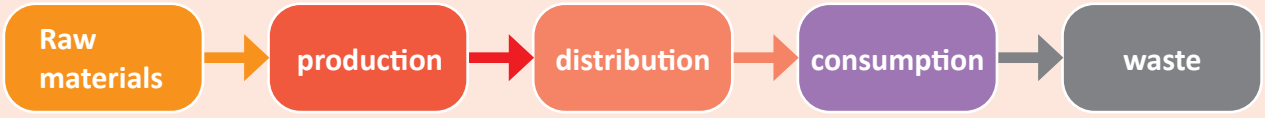


Figure 1 – Linear economy

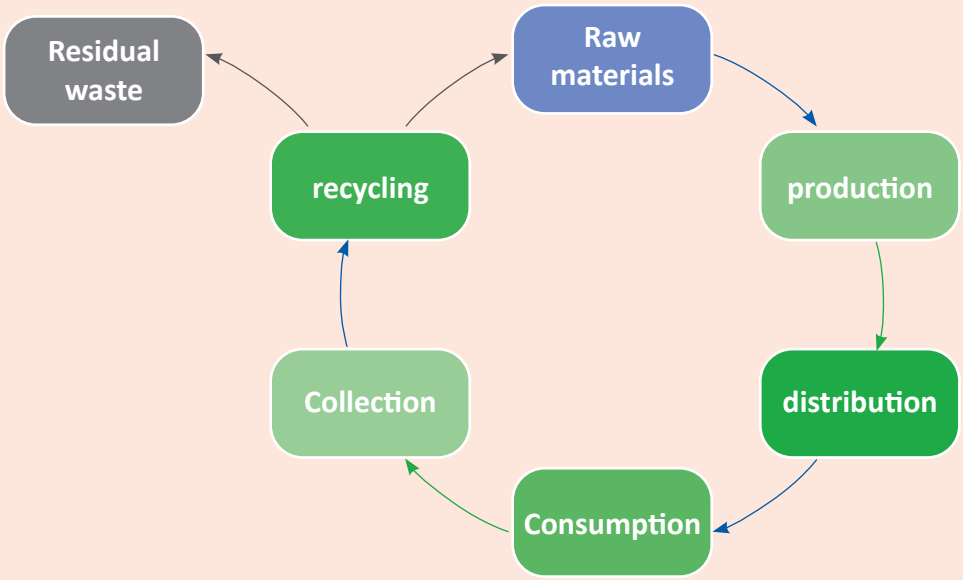


Figure 2 – Circular economy

It is important to contribute to the improvement of the environment, even as an individual, and therefore to use as many green business practices as possible. We can do this, for example, by wearing eco-friendly clothes; washing when the washing machine is full and using the right detergents; in cities, preferring public transport to cars or cycling; encouraging composting and recycling; ...

Last but not least, it is very important to verify information. The ideal is to really look to see if the company or brand that is masquerading as „green“, really is ecological.

10. THE RELATIONSHIP BETWEEN NATURE AND CIVILISATION

Wild animals living in our forests, how to behave in the forest

A) Introduction to the topic (max. 10 min)

When walking in the countryside, you will certainly notice the wildlife. You can meet many **species** here, probably the most famous is the roe deer, but also the European deer, red fox, common wolf, wild boar and many other species. Last but not least, the Brown Bear can be dangerous to us humans.

- Wild animals are shy, as a rule they avoid all humans.
- If we behave quieter in nature, we may see some species, usually on the range.
- Much more often we can come across **game tracks**, usually prints on the ground.
- In spring, we can even see young animals, most often roe deer.

We can see wild animals not only in the zoo, but if we behave quiet even in the wild. Wild animals usually have no natural enemy in the form of predators, so their numbers need to be regulated. For this purpose we have hunters who regulate the numbers of wild game by controlled hunting. At the same time, humans greatly influence the natural structure of the diet that wildlife can find for itself in nature. For this reason, particularly in the winter months, some game species have to be overfed.

B) ACTIVITIES OF CHOICE (10 – 15 years)

Activity 1: Creating a game survey (15 min)

Materials:

✓ blackboard – or alternative with a similar meaning, writing utensils, computing device with internet access (PC, tablet, phone).

Task:

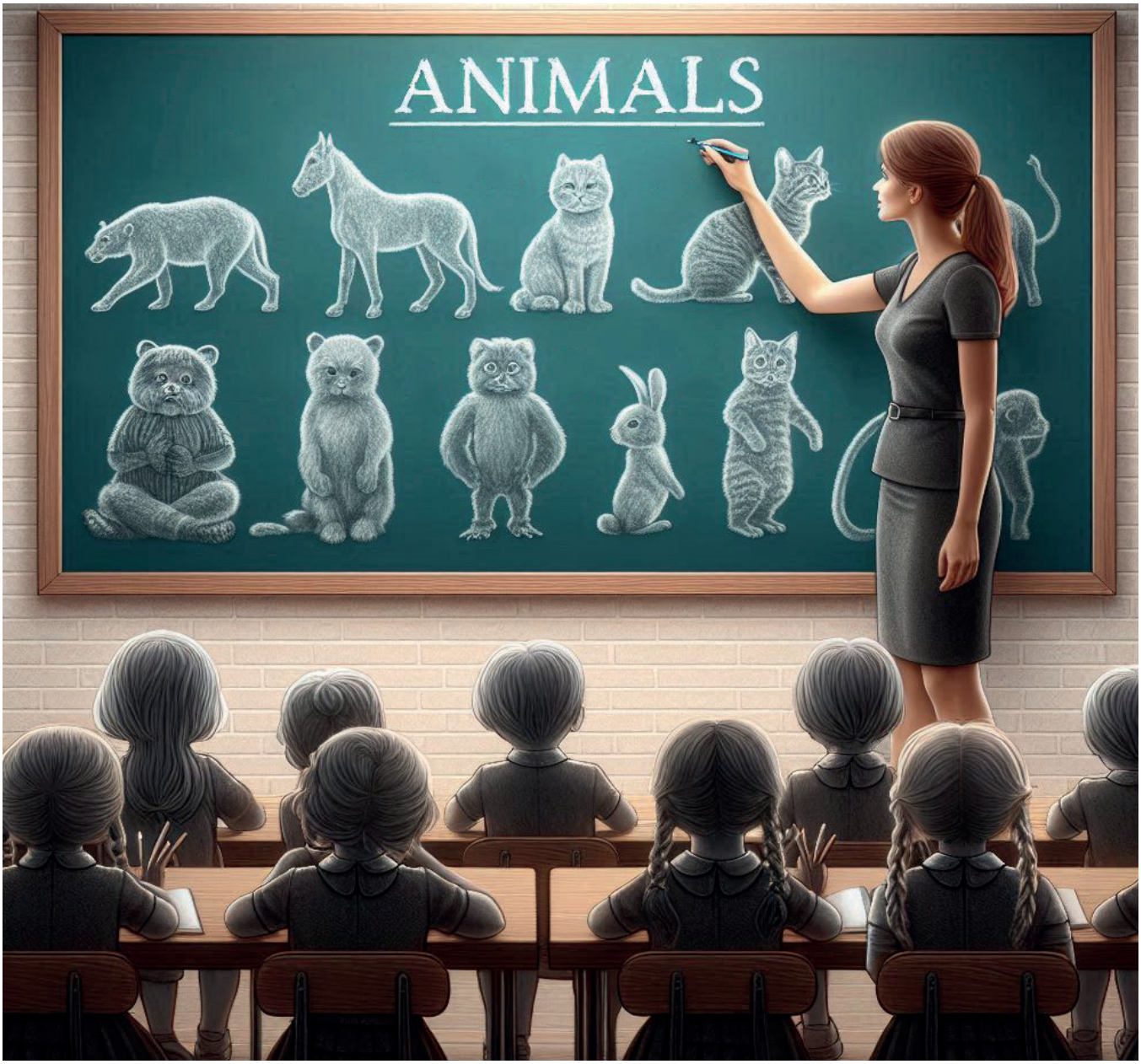
Surely each of you at some point in your life visited a zoo. What have you seen there?

- Try to name the species of game you have seen together and write them on the board.
- When you have written down everything you have seen, try to distinguish which animals you can see in our forests and add any other species you can think of to the board.

Probably you will find out that in the zoo you will not meet many species of game that lives in our forests. You can also use the internet to find species of game that live in our forests.

REMEMBER!

Above all, remember the different species of game you can find in the countryside around you.



Activity 2: Wildlife Recognition (20 min)

What you need:

✓ blackboard – or alternative with a similar meaning, writing utensils, computing devices with internet access (PC, tablet, phone) or textbooks for hunting.

Task:

We now know what wild animals live in our forests. Let's try to name them according to the pictures. You can use the list of wild animals you wrote on the board earlier as a guide. Aren't you sure? You can use the Internet as a hint.

You can write titles for each picture:

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2. 

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3. 

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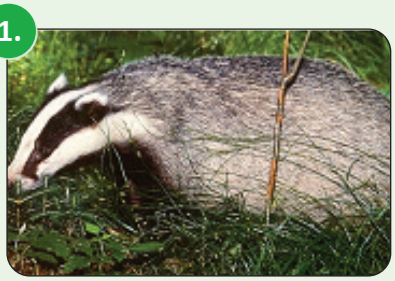
1. 

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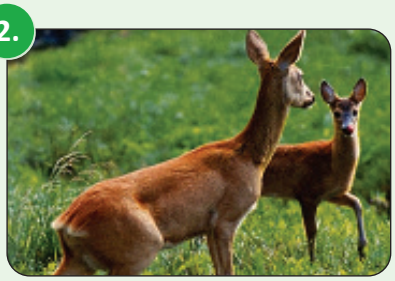
2. 

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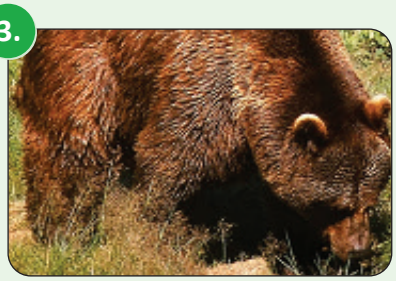
3. 

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1. 

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2. 

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3. 

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Source: ČERVENÝ, Jaroslav, 2004. *Encyclopedia of hunting.* Prague: O ttovo nakladatelství v divizi Cesty. ISBN 80-718-1901-8.

REMEMBER!

Memorize the appearance and name of all depicted game species.

Activity 3: Recognition of wildlife tracks (20 min)

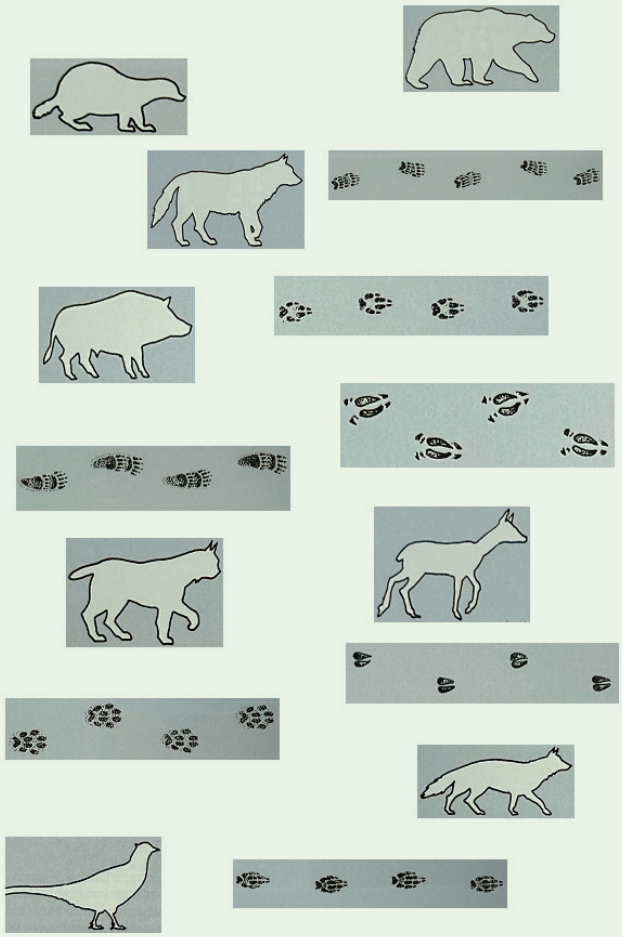
Materials:

- ✓ blackboard – or alternative with a similar meaning, writing utensils, computing devices with internet access (PC, tablet, phone) or textbooks for hunting.

Task:

Now we can name the animals and we can recognize them. If we go out into nature and see a footprint on the ground, for example in the snow or soft ground, can we recognise which animal the footprint belongs to?

The following pictures show game tracks and the silhouette of the game you learned to identify and name in the previous activity. Try to use lines to connect the pictures of tracks and game that belong together. Are you not sure? You can use the Internet to help you.



REMEMBER!

Memorize the appearance of the game tracks, and what kind of game they belong to.

Activity 4: Feeding wildlife (20 min)

What you need:

- ✓ blackboard – possibly an alternative with a similar meaning, writing utensils, computing device with internet access (PC, tablet, phone) or textbooks

Task:

During the winter months, it is harder for animals to find food. This is especially true for roe deer, deer, fallow deer and other game. For the purpose of feeding, hunters have feeding devices called feeders, into which they properly put food, would you know what is appropriate to add to the feeder and what does not belong there? Are you not sure? You can use the internet to help you.

In the table below, write down the types of food that can be fed to game and those that cannot be used:

	Suitable feed for the feeder:	Food that doesn't belong in the feeder:
Types of feed:		

REMEMBER!

You can add the food that belongs to the feeder to the feeder yourself in small quantities. Do not put food that does not belong in the feeder under any circumstances! You can also arrange with hunters in your area to help with the feeding.

Activity 5: School trip – excursion (5 min – discussion of the topic of the trip)

Materials:

- ✓ data projector, digital maps, or a computing device with internet access (PC, tablet, phone) for students. According to the subsequent realization, suitable transport will be arranged.

An idea for a school trip:

If you have nature close to your school, you can go into the countryside instead of staying at school. You will have to behave ⍰⍰higher and then you might see some of the animals you learned about earlier.

Methodological guidelines

Activity 1: Individual contributions of pupils in class, the teacher gradually lets the pupils write their contributions on the board. The teacher assists the pupils with appropriate help. The teacher guides the pupils‘ debate.

Activity 2: Pupils individually write the names of the species for the pictures. The teacher continuously checks for correctness, and depending on the situation, can help the pupils with identification and correct names. The goal is to correctly identify the name and appearance.

Activity 3: Pupils individually link pictures of tracks and pictures of animals with a pencil (for correction). The teacher checks continuously for accuracy, depending on the situation, can help the pupils with identification and correct names. The aim is to correctly link the picture of the game and the track.

Activity 4: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate recording of the types of food in the table.

Activity 5: The length of the walk and its organisation depends on the school‘s disposition. The teacher can plan the event himself, the time scale will be 2 x 45 min.

Core competencies:

Group work will develop key competences, especially social and communication competences. Furthermore, according to the specific task, there will be development of digital competence, imagination, ability to analyse text and critical thinking.

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Learning Resources for Students
(Workbooks and Activities)

Environmental education

1. ECOSYSTEM

Poster Ecosystem

In the theoretical part of the lesson, students will review the problem of the ecosystem, its types and functions. In the practical part then they will create different types of their own ecosystems on a quarter with the help of paint, scissors, glue and the internet. At the end of the practice, it is appropriate for the students to present their short projects to the rest of the class. Afterwards, the class can discuss the functions of the ecosystems and their other components.

A) Introduction to the topic (max. 5 min)

An ecosystem is a general term for a system of living and non-living components of the environment that are interconnected in some way. They can vary in size, but even the smallest ones form an important component of nature. Some affect its balance.

Some ecosystems are constantly under pressure from human intervention and climate change, which can lead to their collapse or even extinction. However, nature provides vital functions for human well-being, and it is therefore very important that people pay attention to this issue and ensure the health of all ecosystems.

The following activities should make students aware of the importance of different ecosystems and make them think about their conservation.

B) ACTIVITIES OF CHOICE (10 – 14 years)

1. **Ecosystem (Theoretical part: 15 – 30 min.)**
2. **Ecosystem production (Practical part: 30 – 60 min.)**

Tools and materials:

- quarters
- watercolours/pastels
- markers
- paper
- scissors
- glue
- Internet
- printer, computer

1. Ecosystem (questions and subsequent discussion of the answers)

- Briefly write what do you mean by ecosystem?

  .....

  .....

- What are the types of ecosystem?

  .....

- Give at least 3 examples for each type:

  .....

  .....

- What is the difference between living and non-living components of an ecosystem (give examples)?

  .....

  .....

- What is the main function of the ecosystem?

  .....

- How do we protect ecosystems? Think of at least 5 examples.

  .....

  .....

- How do we protect ecosystems? Think of at least 5 examples.

  .....

  .....

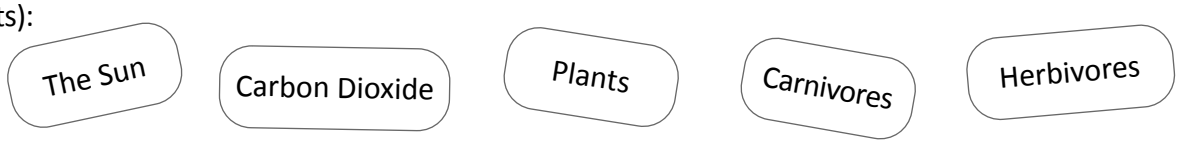
- What all does nature provide for humans (think of at least 3)?

  .....

  .....

- (What is meant by the term food chain and what are its types?)

- Add arrows to the ecosystem cycle diagram (hint –- the arrows show the relationships between objects):



2. Poster Ecosystem (group work)

1. Prepare all the tools

2. In groups, divide the main roles: painter, finder, editor and gluer, presenter.

Painter – his main task will be to paint the design of the poster.
Search engine – its main activity will be to search for important information on the computer.
Cutter and gluer – his task will be to cut out selected pictures and glue them on the poster.
Presenter – at the end of the presentation he will present the final work of the group to the class.
The roles are intended, but whoever doesn't have something to do in their role helps others

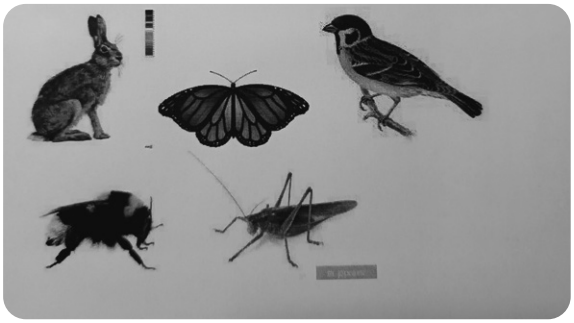
3. Choose one of the following ecosystems: meadow, forest, lake, field, pond, garden.

4. Start working on the poster:

The painter works on painting the design of the chosen ecosystem. He can use any colours and styles.
The search engine looks for at least 10 components that are typical of the selected ecosystem (5 animals = **fauna** and 5 plants = **flora**). He/she finds their pictures and saves them in Word document (be careful about SIZE – the pictures must fit on the poster). The others help.

5. Once the picture document is ready – ask your teacher to show it to you.

6. Once the document is printed:
the editor will start cutting out the images.

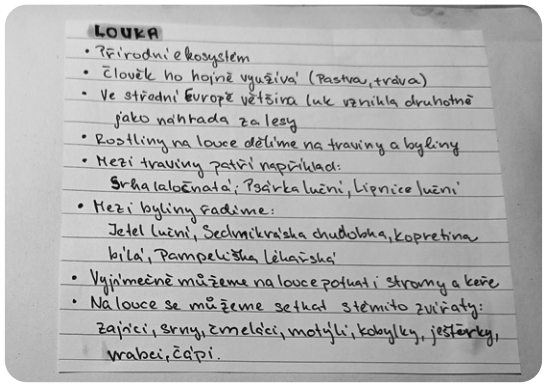


The search engine uses the Internet to search for characters typical of the selected ecosystem. And with the help of the presenter, it creates a presentation for a maximum of 5 minutes.
The presenter writes down the speech on paper.

7. The painter should have the base of the poster ready at this point.

8. The cut-out images are suitably glued onto the poster

9. The presenter and the search engine are finishing the speech. At the end, they paste the the speech on the back of the poster.



LOUKA
- Přírodní ekosystém
- Člověk ho hojně využívá (pastva, tráva)
- Ve střední Evropě většina luk vznikla druhotně jako náhrada za lesy
- Rostliny na louce dělíme na traviny a byliny
- Mezi traviny patří například: Srha laločnatá, Psárka luční, Lipnice luční
- Mezi byliny řadíme: Jetel luční, Sedmikráska druhohorní, Kopretina bílá, Pampeliška lékařská
- Výjimečně můžeme na louce potkat i stromy a keře
- Na louce se můžeme setkat těmito zvířaty: zajíci, srny, čmeláci, motýli, koblylky, ještěrky, vrabci, čápi.

10. Once the other groups are done, all presenters present their poster in front of the board.

REMEMBER!

An ecosystem is a functional system of living and non-living environmental components that interact in space and time. Ecosystems are divided into two types - natural (those that have evolved on their own without human intervention) and artificial (those that have been created by human intervention). Ecosystems can vary in size, but even the smallest ones are an important component of nature and must be protected and cared for.

Nature provides indispensable services to humans, such as food, clean air and water, nutrient cycling, fertile soils and climate regulation. Unfortunately, in the last few decades, biodiversity has been lost due to human activity. Protecting the environment is one of the most important ingredients for maintaining functioning ecosystems, and therefore we need to focus on restoring and growing them. This can be achieved by establishing protected areas and national parks and, last but not least, by not polluting nature.

2. NATURAL RESOURCES

Renewable, non-renewable and sustainable sources of electricity generation

A) Introduction to the topic (max. 10 min)

We often hear around us the topics of **energy sources**, especially where to get electricity in accordance with nature.

If we look around, we see a lot of equipment that runs on electricity. Do we need to run the washing machine at home fill up the petrol tank at the petrol station, pay at the shop with a credit card? These are just a minimal number of examples of what we need electricity for. Let‘s face it, we depend on it and without its power we would be back a few centuries.

- If we want to continue to enjoy the benefits of the scientific and technological revolution and modern technology, we cannot do without electricity.
- **Electricity consumption** is increasing despite the increasing efficiency of appliances, but where can we get it in the quantities we need and in harmony with nature?
- We may eventually replace old cars with combustion engines with electric cars, but where will we get the ex-tremic increase in electricity consumption?

There could be many more questions about electricity production, but where is the electricity produced? I‘m sure everyone knows, but will that be enough? And how will this **production** be in harmony with nature? Yes today we have solutions that already work in harmony with nature.

Let‘s take a look together at what options we have and how to navigate their advantages and disadvantages. We use different types of power plants to generate electricity:

- Coal-fired power plants
- Gas power plants
- Nuclear power plants
- Hydroelectric power plants
- Photovoltaic power plants
- Wind power plants

You are probably all familiar with these power plants and they are somewhere in your area. We certainly have other power stations, such as wave, tidal, geothermal, etc., but do we use them here? We don‘t.

With regard to nature, renewable sources are the best for us, that is to say, power plants that make use of nature‘s inexhaustible resources.

Nuclear power plants are something of a specialty nowadays. Basically, it is the splitting of atoms, which releases a considerable amount of heat energy. It is not a renewable source of energy, but it still has many advantages and considerable power. At present, it is the only technology that is capable of providing sufficient electricity for our homes, industry and possibly even electromobility, and it produces no harmful gases, only a limited amount of nuclear waste.

B) SELECTIVE ACTIVITIES (10 – 15 years)

Activity 1:

Use of electricity (10 min)

What you need:

- ✓ blackboard – possibly alternative with a similar meaning, writing utensils.

Task:

Look around you and try to name all the devices that are powered by electricity? Try to record your ideas on the board, there will be lots of them, try just twenty examples, some will be similar. These can be not only devices connected to a 230 V socket, but also small electrical appliances.

Don‘t worry, you don‘t have to describe the whole board, but when you‘re done, try to think about each example, how would you replace it without using electricity?

REMEMBER!

Remember all the electrical appliances listed and their importance.

Activity 2:

Types of power plants (25 min)

What you need:

- ✓ board - possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone)
- ✓ suitable sheets of paper to create the drawing
- ✓ crayons

Task:

Let‘s now think together and name which power plants are renewable and which are not. We can use the list given in the introductory chapter, or we can help ourselves by looking it up on the Internet.

To explain the difference between nature-friendly power plants and power plants that pollute the environment, we can divide them into renewable and non-renewable power plants. Renewable power plants are those that harness natural energy that can be reused, more precisely, it is an inexhaustible natural force.

Once you have the power stations divided, choose one type each and use crayons to draw a picture of it according to your own ideas.

REMEMBER!

Remember the basic classification of power plants with regard to their environmental impact.

Activity 3:

Types of power plants (25 min)

What you need:

- ✓ board – possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone).

Task:

- Renewable ways of generating electricity (list): ...
- Non-renewable ways of generating electricity (list): ...

How do renewable and non-renewable power plants differ from each other? Think about (or search on the internet) what source is the „driving force" of a particular power plant.

For each power plant, try to describe its advantages and disadvantages: ...

In the following table, write down the characteristics you found:

Sources of electricity	Species – write down:	Benefits:	Disadvantages:
Renewable:			
Non-renewable:			

REMEMBER!

Remember the characteristics of each power plant.

Activity 4:

Environmental characteristics of power plants (20 min)

What you need:

- ✓ board – possibly an alternative with a similar meaning
- ✓ stationery
- ✓ computing device with internet access (PC, tablet, phone)

Task:

Try to name what waste and in what quantity is produced by a nuclear power plant. Compare your findings with a coal or gas-fired power plant (search the internet for the necessary information).

In the following table, write down the information you found about the waste:

Waste	**A nuclear power plant:**	**Gas power plant:**	**Coal-fired power plant:**

REMEMBER!

Remember the waste produced by each type of power plant and its impact on the environment.

Activity 5:

School trip - excursion (5 min – discussion of the topic of the trip)

What you need:

- ✓ data projector
- ✓ digital maps, or a computing device with internet access (PC, tablet, phone) for pupils.
  According to the subsequent realization of the appropriate transport.

An idea for a school trip:

If you are interested, you can try to find any power plant in your area and try to arrange a professional excursion.

Methodological guidelines

Activity 1: Individual contributions of pupils in class, the teacher gradually lets the pupils write their contributions on the board. The teacher assists the pupils with appropriate help. The teacher guides the pupils‘ debate.

Activity 2: Individual contributions of pupils in class, the teacher helps pupils with appropriate clues and guides the pupils‘ debate. She then organizes individual drawing of a picture, which pupils can then decorate the classroom with.

Activity 3: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate writing of arguments in the table.

Activity 4: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate writing of arguments in the table.

Activity 5: Through guided discussion, students find a suitable place for a thematic excursion. The subsequent solution is according to the school‘s possibilities.

Core competencies:

Group work will develop key competences, especially social and communication competences. Furthermore, according to the specific task, there will be development of digital competence, imagination, ability to analyse text and critical thinking.

3. OUTDOOR RESEARCH – RESEARCH ACTIVITY PLAN

Rainwater retention tool, Water retention in nature, Rainfall measurement

A) Introduction to the topic (max. 5 min)

In this activity, pupils learn to measure the amount of rainfall falling on the surface of the ground at their school or home using simple rain gauges made from PET bottles, try processing the measured data and calculations with them in a spreadsheet on a computer, and keep a digital meteorological diary tracking temperature, air pressure and measured rainfall over the school year. From the measured data, the students find out framework requirements for building a simple rain catchment device to water the school garden and create a school pond.

REMEMBER!

- Water is a fundamental prerequisite for life on our planet. Human-induced significant deterioration in the ability of landscapes **to retain rainwater** and climate change in terms of uneven temporal distribution of rainfall with long dry spells and high rainfall events in a short period of time are potentially the biggest environmental problems of today, affecting food production and availability for part of the world‘s population.
- In the case of water, we have the štěs that its molecules cannot leave the Earth‘s atmosphere. It is a closed system that is powered by energy coming from outside the Earth‘s system in the form of electromagnetic radiation from our nearest star, the Sun. It is called the **water cycle** and its part si e **vaporation of water** associated with capillary phenomena and photosynthesis taking place in plants, all meteorological phenomena including wind, condensation of water in clouds, **rainfall and snowfall**, thunderstorms, lightning, etc. When water hits the earth‘s surface, it then forms rivers, lakes and seas by the gravity force of water in liquid form, percolates into the soil, where it is stored in limited quantities as groundwater and reaches the roots of plants, which form organic matter from water, carbon dioxide and nutrients in the soil when supplied with electromagnetic radiation from the sun.

REMEMBER!

- However, there is one slight hitch. When man‘s intensive farming reduces the **soil‘s ability to hold water** and alters the landscape so that rainfall just runs quickly down the rivers to the oceans, plants are unable to extract the necessary amount of water from the water cycle for the biosphere to function, and otherwise life-giving sunlight mercilessly kills them. Drought will gradually turn a previously fertile landscape into an uninhabitable desert. These processes are irreversible according to current scientific knowledge. Yet humans have been aware of the importance of water for their lives for thousands of years and have been retaining rainwater for irrigation since ancient Babylon.

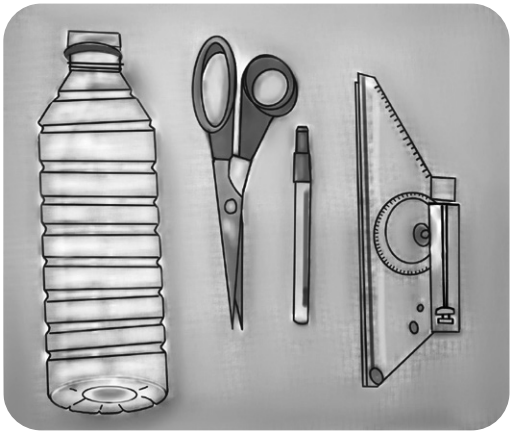
B) ACTIVITIES OF CHOICE (12 – 14 years)

Activity 1:

Rainfall measurement and capture (Theoretical part 20 – 30 min, Practical part 60 min)

What you need:

- ✓ Rain PET bottles, sharp scissors, a paring knife (be careful it is very sharp), rulers, tailor's tape measures, tape measures, graduated cylinders, kitchen or laboratory scales, slats or sticks;
- ✓ Optional: school measuring system with force meter, weighing module, temperature sensor (thermistor or thermocouple)



In this activity, the pupils learn to measure the amount of rainfall falling on the surface of the earth in the school and in their homes using simple rain gauges made of PET bottles, try processing the measured data and calculations with them in a spreadsheet on a PC, and together keep a digital meteorological diary tracking the temperature, air pressure and measured rainfall over the school year. From the measured data, the pupils find out frame the requirements for the construction of a single rainwater harvesting device for watering the school garden and the creation of a school pond. This is the beginning of a long-term group project where it is important to monitor rainfall for at least one to two months.

a Theoretical part (20 – 30 min)

Name the different types of precipitation by their composition.

.....

Name the categories of precipitation according to their precipitation and compare them with the professional names found on the Internet. In the tře□□ho column of the table, add the amount of precipitation according to a trusted Internet source of information.

…….	…….	…… millimetres per hour
…….	…….	…… mm/h
…….	…….	…… mm/h
…….	…….	…… mm/h
…….	…….	…… mm/h

(Hint: drizzle, shower, rain, downpour, thunderstorm)

Recall or look up on the internet the formula for calculating the circumference of a circle.

.....

Remember or look up the formula for calculating the area of a circle on the internet.

.....

Recall or look up on the internet the formula for calculating the volume of a cylinder.

.....

Recall or look up the formula for calculating density on the internet and find the value for the density of water.

.....

Make a list of different containers for liquids and (in a table) write down their shape, dimensions and volume.

.....

.....

.....

b Practical part (60 min)

Rain gauge made of PET-bottle

You can use any container such as a bucket, cup, glass, mug or cut PET bottle to measure rainfall. The measurement area is always determined by the neck of the container. Therefore, containers with vertical side walls are suitable and, conversely, containers tapering towards their neck are unsuitable.

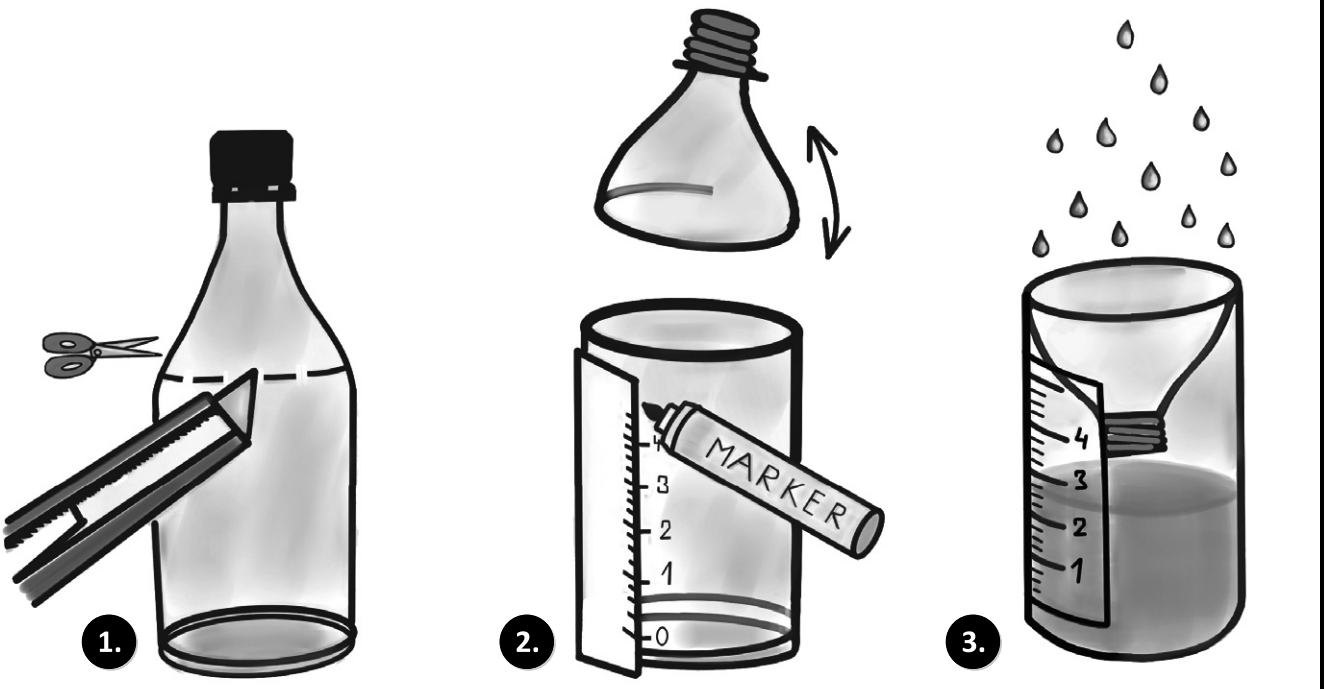
During the measurement, a portion of the captured water evaporates from its free surface. How can the effect of this phenomenon be minimized?

Use the cut-off part of the PET bottle as a funnel. Insert the cut-off top of the bottle into the bottom of the bottle with the cap threaded downwards, thus obtaining a precipitation catching surface area many times larger than the size of the bottle neck opening and at the same time reducing evaporation from a large part of the free surface of the liquid.

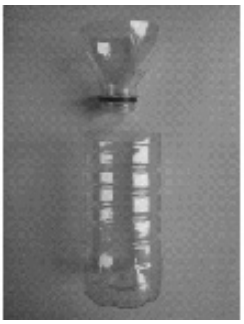
Workflow

1. Prepare all the necessary tools on your workbench. Cylindrical PET bottles with a volume of 1.0 to 2.0 litres and vertical walls at the bottom of the bottle are suitable.

2. Cut off the part of the PET-rope where it starts to taper. Turn the cut part of the bottle with the thread facing downwards and insert into the cylindrical base without gluing. If you have worked accurately, it will hold after insertion by frictional force only.







3. Measure the diameter of the PET-boat directly with a ruler and calculate the area of the precipitation meter on a PC in Lib- reOffice Calc. This method of measuring the diameter of the PET-boat is laden by significant systematic error.

4. Therefore, measure the circumference of the cylindrical part of the PET-boat at three different heights and calculate the area of the collision by substituting the radius thus obtained from the modified formula for the circumference of the circle into the formula for the content of the circle. Which method is more accurate?

5. The PET bottle does not have a flat bottom. Before measuring a small amount of rainfall, the measuring container can be filled with enough water so that the level is zero in the area where the PET bottle is cylindrical. However, do not fill it with water yet.

6. Now the rain gauges need to be tagged. Stick a millimetre scale on the side of the PET-boat, for example a thin flexible ruler or a millimetre scale printed on a laser scanner notransparent film (Meotar film). If you have neither, a scale made with non-washable alcohol marker in 5 mm increments will also suffice.

   The second possibility is to mark the rain gauge in volumetric units using a laboratory graduated cylinder and then convert to the height of the water column in the cylindrical measuring vessel. The spreadsheet editor LibreOffice Calc is also a good tool for this.

7. Place several rain gauges on school property. You can also take measurements at home in the garden or outdoors, for example in a park or field outside the city. Mark the spot with a laminated sign and check it regularly to ensure that no one thinks it is littering and removes the rain gauge.

8. When taking measurements, place the rain gauge in an open area on a horizontal pad. The measurement area must not be covered by branches or be too close to buildings, walls or fences. All of these could affect the measurement in wind conditions. In the open air, secure the rain gauge against flipping over by sticking a few sticks or branches around it.

9. Create a group meteorological diary for school measurements and your own meteorological diary for daily measurements. It used to be a paper notebook. Today it is more like a notebook in Libre-Office Calc. In the spreadsheet, record the date and time, air temperature, air pressure, and the measured water column height in the rain gauge (or precipitation volume). You can measure the air pressure data using a weather station, a school measurement system, or by checking the current weather forecast.

10. Determine the intervals at which you will enter data into the table, i.e. at what intervals you will measure the level in the measuring vessel. This is called the sampling frequency or sampling rate. Under normal conditions, it is sufficient to record a reading of 1 time per day, 1 time per hour for heavy rainfall, or 10 minutes for shorter showers, or record the total amount of rainfall for a given event. For example, X mm of rain fell this afternoon during 47 minutes of rain, or Y ml.

11. From the daily data, use the LibreOffice Calc spreadsheet to calculate the rainfall for one week, for the whole month and finally (if you can keep measuring long enough) the annual rainfall.

12. Convert the mm of rainfall in the cylindrical container to the volume of rainwater in millilitres. What is the volume of water in a PET bottle that represents a 1 mm increase in level at 20 °C in the approximately cylindrical part of the bottle?

13. Compare results from different measuring vessels and measurements at other locations. How do they differ? What might be the reasons?
    Discuss. Discard the results with gross error and calculate the mean values from the relevant results for each location.

14. Calculate, knowing the floor plan of the school building, the volume of rainwater discharged from the roof of the school annually into the storm sewer. What is the value of this volume of water at current water and sewerage rates?

15. Instead of measuring the water level in a cylindrical container, you can weigh the container using a precision kitchen or laboratory scale and calculate the volume of the liquid by knowing the density of the water.

16. The task can be optionally automatized and the force values can be recorded every 10 minutes or even every minute. Hang the measuring container on the force gauge and measure the volume of water indirectly via the weight (or applied gravity force) of the water in the container, which gradually fills with water as it rains.

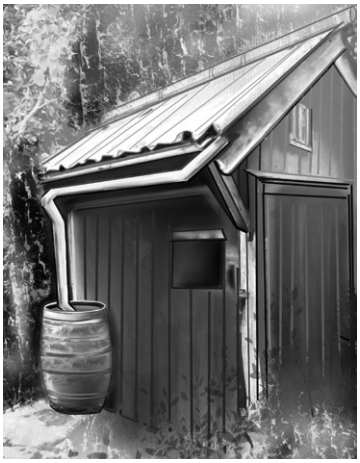
    WARNING: *The force gauge module, the supply wires to the force gauge module and the measuring interface must be protected against rainwater. Suggest how to achieve this.*

Core competencies:
At the end of the chapter, go back over the individual actions with the students and have them summarize the specific knowledge and skill gains in their own words using the questions, „What new things did you learn from building the rain gauges? Which concepts did you remember? Which procedures were new to you? Which activities did you enjoy?“

The students can reflect on the learning process in a group orally or in a notebook in writing in individual struggles and then hand it in to the teacher. Similarly, a digital whiteboard or even an ordinary whiteboard can be used for pupils to write down their thoughts in a quick brainstorming session.

An idea for a long-term project.

Would you like to explore this topic in more detail? Then you will appreciate the suggestions for these two actions, which are more time-consuming but very useful.



Garden shed with guttering and barrels

What you need:: buckets, barrels, hoses, hose connectors, plastic pipes, aluminium gutters, aluminium gutter fittings, gutter mounting brackets, riveting pliers, battens, screws, tape measures

School garden pond (biotope)

Materials: plastic sheeting or large sturdy garbage bags, rounded stones, water plants, garden tools (shovel, hoe, pick, garden wheel)

4. DIFFERENT TYPES OF PLASTICS AND THEIR PROPERTIES

The game Tic-Tac-Toe

A) INTRODUCTION TO THE TOPIC

The treatment of **residual plastic materials** is one of the key components in the waste recycling hierarchy. At the same time, it is also related to the waste of other resources. For further processing of plastics, it is necessary to know their properties, which can be derived from the originally produced objects and at the same time according to their groups, i.e. it is necessary to know their **labels**.

By combining recycling and **saving other resources**, new interesting products are created that maintain real activity of pupils and lead to versatile skills as well. Creating new products from residual (waste) materials demonstrates recycling in practice at an individual level with available resources.

However, a key factor that has a major impact on plastic waste pollution is the reduction in the production of plastic products and packaging materials. Recycling and reuse of plastics must be addressed secondarily, as it is more difficult to cover the ever-increasing amount of plastic waste generated rather than to reduce its quantity in the context of production.

B) ACTIVITIES OF CHOICE (9 – 11 years)

1. **Marking and use of plastics (theoretical part 15 min)**
2. **The game of tic-tac-toe (practical part 30 min.)**

What you need, materials used:

- plastic bottle (PET)
- plastic lids 6 pcs. and more
- scissors
- coloured/white paper or A4 quarter 1pc
- black alcohol based marker
- crayons
- markers or watercolours
- Eurofoils 1pc
- ruler
- crimping knife

1. Marking and use of plastics

Safer plastics

Each plastic has its own special mark, do you know what to find under each number? Talk to your classmates, try to list the types of plastic materials and under each label.

Plastics to avoid

Look around the classroom to see if you can spot them on any products. Write each product together with its label.

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Did you know that recycling plastics produces other different plastic materials that may not look like the landbased ones? Try looking up what is made from recycled plastics.

Write down the individual labels and what is made from their recyclates. A picture can also help.

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Imagine you have 20 plastic caps in front of you. Try to think of all the things you could make with them or what they could be used for when you no longer return them to the bottle. Try to figure out different modifications to plastic materials for use in f.ex. heat sources.

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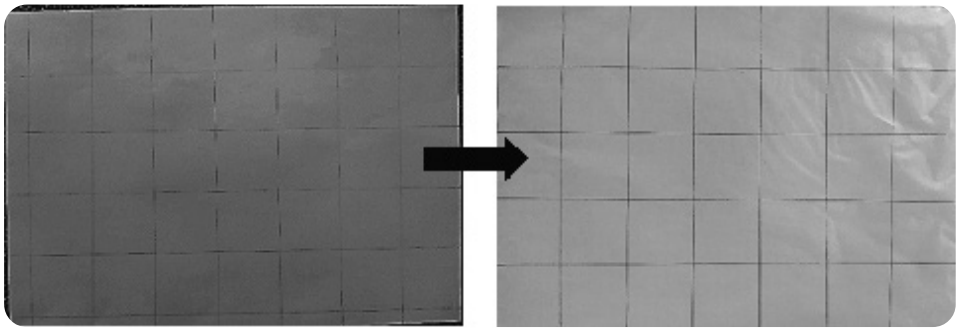
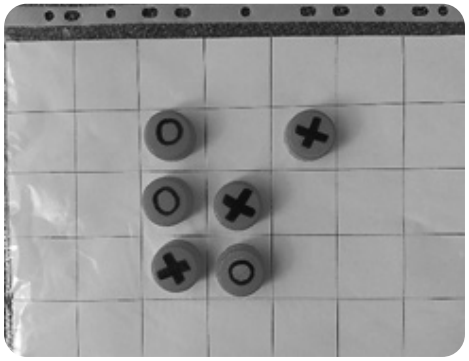
2. Game of Tic-tac-toe

1. Make a square grid on white paper size A4. The squares are 4 × 4 cm. Cut off the excess strips, highlight the square grid and put it in foil.



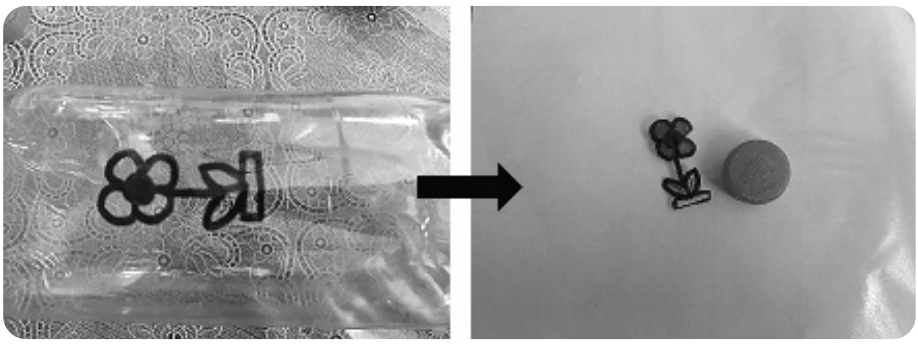
2. After inserting the square net into the eurofoil, we get a playing area. Pupils can decorate this area as they wish.

3. Use the plastic caps as game pieces. The simplest way to mark the lids is to label them on the top with the characters typical for this game, crosses and circles, both in the same amount.

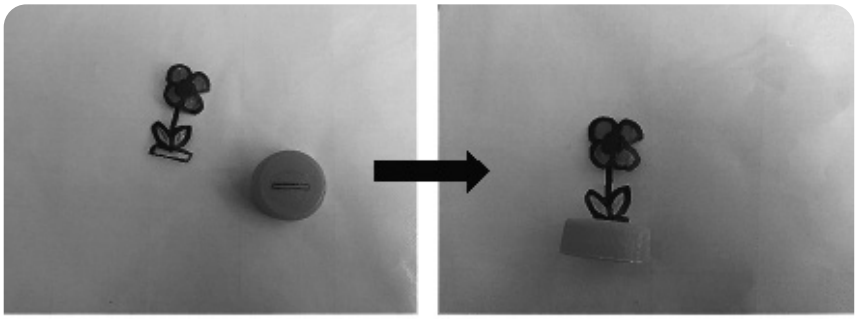


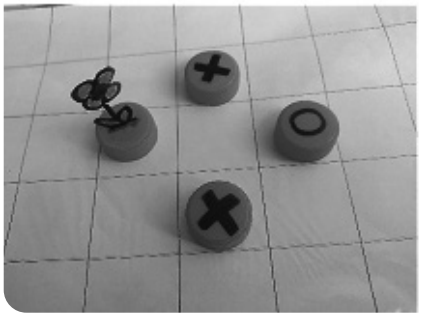
4. The figures can be further decorated in various styles, for example with use of other residual plastic materials.

4a We use an old plastic bottle, on which we paint any pattern, including the bottom handle, and cut out or colour it.



4b Cut a line approximately 2 cm long into the plastic cap to insert the chosen pattern. New unique multi-dimensional pieces are created.





5. The Eurofoil is also used to store game pieces, and prevents their loss. At he same time, we can create as many game pieces as we want for multiple players.

REMEMBER!

We produce various types of everyday products, tools and packaging materials from plastics. We encounter plastics every day, for example in toys, electrical packaging and food preservation packaging. Each plastic has a different designation, this designation determines not only its internal chemical composition but also its properties. Plastics can be recycled to a certain extent, but only to a limited extent; when recycled, plastics degrade (lose their original properties). This is why recycled plastics are often used to make different products. If recycling is inefficient for some reason, it can be used as a source of heat (electricity) in incineration. The key to reducing plastic pollution is to reduce their production.

Core competencies

During the implementation of the project, pupils will primarily develop the key competence of work. They will practise working with tools, instruments and equipment, observe the rules for work safety and practise working according to the work procedure. Various complications may arise during production, so pupils can indirectly develop their problem-solving competence. In the theoretical part, pupils will then develop their digital competence by searching for information on different types of plastics. If they work together in groups, they will also develop the key competence of communication. The content of the project itself develops the key competences of citizenship in the context of understanding basic ecological context and environmental issues.

Methodological guidelines

The time estimate for the activity is 45 minutes. The theoretical part should take about 15 minutes and the practical part the rest of the lesson. In the theoretical part it is possible to use internet resources in group work followed by verification of the information. The time needed to create the Tic-Tac-Toe may vary, also in relation to the chosen level. It will depend on the creativity and skills of the pupils, and possibly their innovation. Safety at work when handling sharp tools is also important here. At the end of the activity, it is advisable to have a discussion with the pupils on the topic, including a check of the worksheets together with a demonstration of the products. For testing, including checking and discussion, I recommend rather two lessons.

In the theoretical part, it is not so important that the pupils answer everything correctly, but that they become familiar with the terms and concepts and try to be creatively involved in inventing possible types of other products. At the same time, they should also be aware of the nature of recycling, both in theory and in practice, it is not only about recycling but also about conserving other resources that are commonly used in this activity, which could be said to be wasted, namely paper.

In the workflow you can also omit the paper itself and draw the square grid directly on the foil, we recommend using a permanent marker and a harder foil for this procedure. At the same time, the creation of the game pieces is left to the students‘ creativity. The simplest possible principle is indicated in the workflow, but pupils are free to improve the game pieces and the square grid as they wish. The activity is modified in the way that even weaker pupils can master it and more able pupils can modify it to suit themselves.

The advantage of this activity lies in its simplicity and the possibility of various adaptations with using other possible materials. When using drawing aids, alcohol based permanent markers are preferable.

Multiple games of a similar type for multiplayerss can be made on this chosen principle. For example, *Ludo, Checkers or Chess*.

5. HOW TO PROTECT THE ENVIRONMENT?

Environmental actions at the individual level

In the theoretical part of the course, students will review the basic concepts of ecology and learn the principles of environmental protection at the individual and community level. In the practical part they will learn to calculate their ecological footprint, identify which human activities are most damaging to the environment, they find out what the **energy intensity of household operation** depends on, the energy intensity of personal transport and production processes, the different modes of freight transport and storage of goods, and how to improve their efficiency. At the end, students propose their solutions to current problems of civilization, present them in a group and discuss them together.

A) Introduction to the topic (max. 5 min)

Man‘s behaviour naturally shapes the world around him and thus shapes the environment of his species. This includes the construction and operation of human dwellings, the production of food, clothing and other goods, transport infrastructure and everything that contributes to a comfortable life. In the long term, however, it is proving unsustainable to simply draw on fundamentally limited natural resources without thinking, turning them into waste after rapid consumption and releasing often highly toxic emissions into the air from the production and transport of new and new goods. Existing generations, for now, are only passing this pressing problem on, and with the accelerating rate of consumption, the time available natural resources will be sufficient to sustain the lifestyle we are used to is getting shorter and shorter.

B) ACTIVITIES OF CHOICE (13 – 15 years)

What you need and materials:

Computers, tablets or mobile phones with internet connection, printer, DIN A4 size sheets of paper, large format wrapping paper or DIN A0/A1 sheets, writing utensils, paper glue, glue for leather and rubber, scales, waste materials such as PET bottles with lids and others according to the specific activity.

Activity 1: „Our Customer, Our Master“ or what the consumer can change in a market economy (45 min)

Packaging materials, shelf life, storage and transport of food

Look around you and try to name all the devices that are powered by electricity? Try to record your ideas on the board, there will be many, try just twenty e x a m p l e s , some will be similar. This can be more than just When shopping with your parents, note what goods they buy and then fill in the table at home with the different types of goods, especially different foods, and study the information on their packaging. Collect the empty washed packaging, sort it by material, find out the weight by weighing it, write down the information you need and use the packaging for creative projects or take it to the recycling bin.

Food type, packaging material, shelf life, weight of contents, weight of packaging, distance

…….. …… …….. ……. g …… g …… km
…….. …… …….. ……. g …… g …… km
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Consider empty food packaging and record the data in a table. If you do not want to unpack the product yet, calculate the weight of the packaging from the weight difference of the whole product and the weight of the contents. Quickly return chilled and frozen foods to the refrigerator. Record the data in a table and compare them with each other.

Using a spreadsheet editor on your computer, calculate the weight ratio of the contents of the food to the weight of its packaging. For which food does the packaging weigh the most?

From the food packaging, find out the shelf life of the food in the packaging and the storage conditions. Which foods have the longest shelf life? Why?

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In which packages do foods have a long shelf life and why?

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Transport of goods

Find out from the food packaging where the food comes from and use maps on the internet (e.g. Google Maps) to find out the distance between the place of production and your home. Write the figures in a table.

Circle which foods were produced locally within 50 km of the city. Which are from the Czech Republic and which were imported from abroad? Which item on the shopping list was produced farthest away?

The next time you buy, check whether there is a regional alternative for food imported from far away.

Waste diary

How much plastic, paper, glass and metal packaging do you recycle per week?

Paper	Artificial matter	Glass	Tin cans	Beverage cans
..... g	..... g	..... g	..... g	..... g

What is the above packaging made of? What is the primary raw material for production?

....

Which packaging materials are sustainable? Please circle.
What can empty packaging be used for?

.....

Which food packaging is recyclable and in which container or waste receptacle does it belong?

Blue	Yellow	Green	Brown	Black (remaining municipal waste)
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

Find out on the internet how much energy is needed to produce 1 kg of paper, 1 kg of plastic, 1 kg of steel and 1 kg of aluminium sheet.

Paper	Plastics	Glass	Steel sheet	Aluminium sheet
..... kJ	..... kJ	..... kJ	..... kJ	..... kJ

Find out on the internet how much carbon dioxide is produced in the production of 1 kg of the above materials.

..... g ..... g ..... g ..... g ..... g

Activity 2: Let's try to fix it (45 min)

Direct recycling in practice

Some products wear out with use and need to be either replaced or repaired. For example, did you know that shoe soles used to be repaired? Nowadays we mostly buy new shoes.

Which products wear out and how long do they last?

Product	Duration of use	Method of repair
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……

DIY-Project:

Try repairing the worn out sole of the shoe (most often at the heel) with a slice of rubber obtained from a worn out cyclic tire (otherwise also discardable) before discarding. First, ask for the help of an adult, because it is necessary to remove the wooden reinforcement of the cyclocase with pliers and a sharp folding knife. Then you can proceed on your own. Cut out the necessary size slices of rubber from the flat centre of the tread or from the sidewall of the tyre with a pair of tin snips. Clean and lightly roughen the sole of the shoe with sandpaper, apply rubber adhesive to the sole and the patch of the cycloplast, press the patch firmly after setting the adhesive and pull it off with a parts clamp. Allow the glue to set and dry ideally by the next day. Use several strips of tread for a larger area. Highly worn wide mountain bike tyre treads are ideal. One worn cycloplast is sufficient for the sole area of one pair of shoes. You can get a large sheet of rubber for the entire sole from a car tire either from its smooth sidewall or after removing the metal reinforcement from the tread with the remaining tread pattern.

ATTENTION:

Automotive tyres must be cut with a sharp tool. In this case, ask an adult for help. Never cut a tyre yourself. You can only work safely with the resulting rubber sheet.

Activity 3: „Don‘t throw away, exchange, donate“ (45 min)

Direct recycling in practice

Internet exchanges (15 min)
Search the internet for advertisements to exchange and donate goods that are no longer needed. You can find them in the internet search engine under the keywords „don‘t throw away“, „donate“, „for removal“ and also on social network. Maybe someone is just about to throw something away that you need, and a small gift of a sweet will make them happy.

What have you found on the internet and where?	**Distance**
……	…… km
……	…… km
……	…… km
……	…… km

School Exchange and Flea Market (minimum 35 min. for class, 1-2 lessons per school)
Organize a classroom auction of things you no longer need. First, ask your parents if you can donate or exchange the item. Write the names of the items on cards and post notices on the classroom bulletin board telling who is going to throw what away (offer, „I‘m offering“) and what they are looking for (inquiry, „I‘m looking for“).

Donate (e.g. old laptop without HDD or mobile phone)

……

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I‘ll trade (e.g. an L for an XL, a kit for 2 apples, etc.)

……

……

Organise a classroom or school-wide fair, like a flea market, where others can see and try things out. The categories of the game are „donate“ or „exchange“. In this game you cannot exchange the item for money, only for another item or for fruit. Unhealthy sweets do not belong in school.

Some things nobody wants anymore, but they can be used for spare parts or for experimenting, playing and understanding the function of devices and then taken to the recycling yard according to the recycling policy.

ATTENTION:
Never open or disassemble electrical appliances with a power supply inside. There is a risk of electric shock. Even with the unit disconnected, the capacitors are still charged!

REMEMBER!

You don‘t have to throw every item you no longer need in the bin. Many products can be repaired, donated or repurposed. So even a broken item can still bring joy and knowledge.

Activity 4: „My house, my castle“ or the energy demands of the household (45 min)

In addition to industrial production and transport, energy demands of households make a significant component of the total energy required for the functioning of human society. Find out how much energy your household needs to run. Use a spreadsheet editor to calculate.

Electrical apparatus

From the electricity supplier‘s bill, find out the average monthly and total annual electricity consumption of the household. Compare the data with each other in the classroom.

…… Wh per month …….. Wh per year

Use your apartment or house meter to find out what your household‘s average daily and weekly electricity consumption is. Use a spreadsheet editor to calculate.

…… Wh per day …….. Wh per week

Use wattmeters, so-called measuring sockets, to find out the power consumption of individual appliances in the home. Compare the data with each other in the classroom.

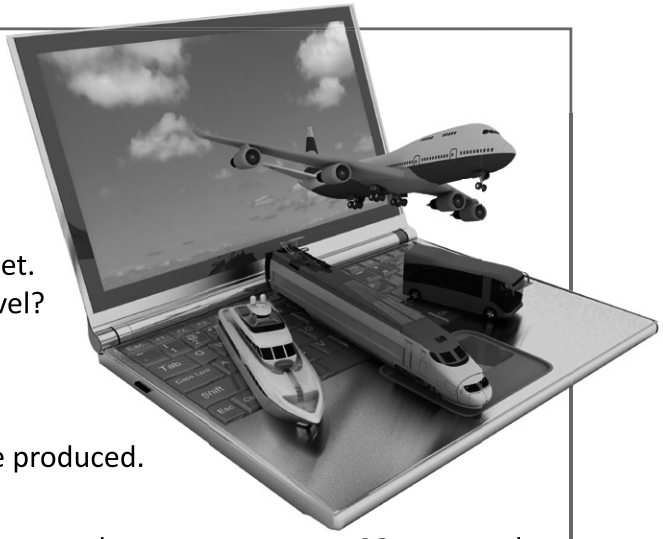
Instrument	**Power input**	**Time of using in hours per day**	**Electrical energy consumed**
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh
……	…… W	…… h	…… Wh

Household heating

Find out the monthly and annual consumption of heat or gas from the bills of the heat supplier (district heating from the heating plant) or gas supplier. Cooking on a gas cooker can be neglected in relation to the gas consumption for heating. If you heat with wood, find out how much wood, pellets or coal you need for the season and the calorific value of the fuels used. Compare the figures with each other in the classroom.

With gas heating, you can see your gas consumption almost in real time on the gas meter. Enter the meter readings at regular intervals (e.g. every day at 8 p.m.) into a spreadsheet and calculate your weekly gas consumption.

Reduce the temperature setting on the thermostats by 1°C and repeat the gas consumption readings for one week. What did you find?



Activity 5: „To work and to travel, we'll go around the world" (45 min)

By car, by plane, by boat, by train?

Look up your family car's fuel consumption on the internet. How many kilometres a week does your family car(s) travel?

Find the CO emissions data2 for the fuel type used (petrol, oil, LPG). Convert using the spreadsheet editor. the amount of fuel burned per amount of carbon dioxide produced.

…… km pre week …….. litres per week …….. g CO_2 per week

How many people are riding in the vehicle at one time? What is the balance per person?

…… persons …….. g CO_2 per week per person

Find out on the internet what is the average fuel consumption of a train or bus journey, what is the number of passengers and what is the resulting energy consumption and CO2 per person using public transport. Compare and discuss in a group the values found with the result of the calculation for the passenger car.

Automobile:	…… g CO_2 per km	…… CO_2 per person per week
Bus:	…… g CO_2 per km	…… CO_2 per person per week
Train:	…… g CO_2 per km	…… CO_2 per person per week

You are going on a holiday to Croatia and you are deciding whether to go by car, train, fly by plane or part of the way by ferry.

Use maps on the internet to find out the distance from your location and home to your destination by road, rail and as the crow flies.

…….. km by road …….. km by rail …….. km by air

Calculate the amount of fuel (or more generally energy) needed to cover this distance by different means of transport. Consider a flight on a large aircraft with full capacity and a fully occupied train. Report the consumption per number of passengers on a relative basis. Compare car and bus.

…….. on the road by car

…….. by road by bus, …….. by rail …….. by air

Find out on the Internet the amount of carbon dioxide produced by burning petrol, oil, aviation petrol and energy mix in production of electricity in Europe.

…….. g CO_2 on the road by car

…….. g CO_2 by road by bus, …….. g CO_2 by rail …….. g CO_2 by air

Key competences

Working in a group, pupils develop social skills. Working independently and in groups, they develop problem solving skills, information retrieval and orientation in large amounts of data, information sorting, analytical and critical thinking.

At the end of the lesson, the students will realize how much waste is produced in food production. They will also learn what to do with the waste produced. They will also learn how not to create new waste by repairing materials and recycling used items.

By thinking critically while monitoring the amount of energy consumed, they will find ways to save energy.

By tracking the carbon footprint of their domestic car, they will realise that using other modes of transport, such as cycling or walking, will reduce their carbon footprint.

Methodological guidelines

The time estimate for these activities is one to two lessons (45 minutes). Students work autonomously in groups under the supervision of the teacher according to the tasks and guiding questions. It is possible to divide the class into groups, with each group solving part of the whole lesson and then presenting their findings to the class.

6. SORTING AND RECYCLING

Waste treatment

If we want to get the pupils excited about the topic, they can take their own open fridge at home.

During the first, theoretical part, the pupils clarify the breadth of the problem of waste sorting by means of a questionnaire and practical examples from their own environment. They will see what bins can be found in their neighbourhood and use the Recycling Bins in the UK activity to realise the differences in different countries.

To conclude the theoretical part, it should be emphasized that the ideal is not to create waste, but to recycle or upcycle it. In the practical part of the activity, the pupils take on the role of an extreme minimalist. At the end, they will try to create a simple product in groups (ideally in pairs) using commonly available recyclable materials. They will present this product and together they evaluate the idea and its design.

A) Introduction to the topic (max. 5 min)

Wastes can be classified according to various criteria: origin, composition, degree of hazard, etc. For the purpose of this project we will be interested in the division according to the recoverability. Recycling of waste materials should be part of our daily routine.

Waste management is a matter that can be influenced by the behaviour of each individual. One Czech produces more than half a tonne of municipal waste per year, according to data for 2021. We need to spread awareness of good waste management and adopt the **3Rs (Reuse, Refuse, Recycle)** rule, which aims to reduce the amount of **municipal waste**. Reuse – reuse what can be reused and don‘t buy new. Refuse - let‘s learn to refuse, let‘s not be tempted to buy things that are unnecessary or inappropriately packaged. Recycle – let‘s recycle, let‘s sort properly.

In the modern world, the emphasis is on **minimalism and upcycling**. Upcycling is the process of repurposing unused products or waste materials and finding for them new use. Often it is designused art. Particularly with light metals (cans, tins) this trend is welcomed and there are many ways how to make decorations and practical home or garden accessories.

REMEMBER!

The primary goal of man is not to produce waste and in the case of waste already produced, solutions must be implemented to reuse it využi through recycling/upcycling and overall reduction.

B) ACTIVITIES OF CHOICE (12 years)

Tools and materials:

- ✓ For the warm-up activity we will need: a photo of the fridge with the contents, crayons.

For the practical part we will need the materials listed for each activity, it depends on your own choice of project.

The other actions are without aids and use only the waste materials listed.

Activity 1: Warm-up activity – My fridge (theoretical part with home preparation 10 – 15 min)

In the photo you can see (your) fridge. Can you find the different types of waste materials? Write them down and colour them with the colour of the container you would throw them in.

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Activity 2: I sort, you sort, we sort – discussion + game (theoretical part 10 min; questionnaire 10 min)

...do they also sort?

You must have noticed the containers around you at school, at home, in your neighbourhood. But have you noticed that some places (e.g. abroad) sort waste differently? What caught your eye?

You can take notes during the discussion with others.

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Try to check your knowledge of sorting in England.

Play INSTEP. If you're surprised by anything, write it down.

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What is the situation in our area? Let's vote and work together. (1 person can write the number of votes and write back to make a certain statistics).

1) Do you sort your waste?
   a) Absolutely.
   b) Occasionally.
   c) I don't sort.

2) If you don't sort your waste, why?
   a) The containers are far away.
   b) Containers are missing.
   c) The containers are full.
   d) I'm lazy/I'm too lazy to sort
   e) It doesn't make sense.

3) Are you sure where the waste material belongs?
   a) 100% yes.
   b) Mostly, yes.
   c) Rarely.
   d) I don't know.

4) If you are not sure how to sort the waste
   a) You try reading the packaging.
   b) You ask someone.
   c) You find out elsewhere (e.g. internet...)
   d) Dispose of the packaging in mixed waste.

5) Do you understand the sorting information on the packaging?
   a) Yes.
   b) Sometimes.
   c) I don‘t understand.
   d) I didn‘t even know it said that

6) Do you know how to use sorted waste?
   a) Yes.
   b) A little bit.
   c) I can‘t think of anything.
   d) I don‘t care. I have

7) What waste do you sort?
   a) Paper.
   b) Plastics – just bottles.
   c) Plastics.
   d) Glass.
   e) Electronic devices.
   f) Bio-waste.
   g) Other:

8) Do you know where your nearest can container is?
   a) Yes.
   b) I think so.
   c) I don‘t know.

9) How do you manage bio-waste?
   a) I don‘t sort bio-waste.
   b) We take them to the collection yard.
   c) We have compost.
   d) I sort into the bio-waste bin
   e) We feed animals with it.

Space for comments:
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Activity 3: Optional, long-term project

Moon in a basket (practical part full of various activities promoting inter-subject relations)

Here you will find tips for project-type activities and their possible inclusion in other ssubjects to strengthen cross-curricular relations.

1. Moon in the paper basket

Pupils are asked to organise a paper collection competition. The whole school can take part, the competition is held in teams (classes or groups), they should make rules about what does/does not belong in the collection, how it will be handed over, stored, what the deadlines will be, how the evaluation will take place and if there will be any reward for the winner. Finally, they must not forget to arrange redemption or other use the paper.

This activity promotes collaboration, organisation and critical thinking. During the evaluation, they will use one-way math and they find out in practice how paper collecting works..

2. Moon on the sheet

Cans and preserves are often an overlooked item in waste sorting. Talk to your pupils about where the nearest metal waste container is, what Iron Sunday is and what waste belongs in metal (clean yoghurt lids, metal caps, aluminium cans and tins, etc.) and what belongs elsewhere (spray cans belong in hazardous waste, coloured coins in the collection yard, etc.).

If you can arrange for pupils to bring cans and tins to school, you can then carry out all sorts of experiments in the classroom.

Music lesson – Make your own drum set

You will need: different sized cans with the lid removed, an inflatable balloon for each of them, scissors and chopsticks as drumsticks (you can also play with your fingers or make chopsticks out of paper). Cut the balloon and pull it as tightly as possible over the open part of the can or tin. Use chopsticks or your fingers to drum and compare the sounds of different sized „drums“.

Physics – Experiment

Give the students a few minutes with their mobile phones or PCs to look up experiments with the skin. Students can report back and explain what is implosion, atmospheric pressure, dissolving aluminium using the waste counter, experiments with gallium, balancing a can on a glass, rolling a can using electrostatic force, etc. If you are equipped to do so at school, you can set up and perform any of the experiments safely.

Physical education – Olympics on the sheet metal

Discuss with students the problem of doping, read the ingredients of an energy drink or non-/alcoholic beer in a can. Have an unconventional Olympics with different stations using cans/canned food.

Possible stations:
squats with a can on the head
skittles (cans + paper ball) throw the can into the distance
building a can tower relay race with a can
long jump (measuring with cans) hitting a can with a pebble
basketball
There are no limits to your imagination, just be careful that there are no sharp or cutting edges on the cans/tins.

3. Moon in plastic

Just take a look at the composition of your wardrobe - especially the labels and materials. Acrylic, elastane, polyamide, polyester, latex... synthetic fibres from petroleum. Let's talk about where we encounter plastic in everything and try to figure out how it can be upcycled.

What products could be made from plastics generated in your home?

- Sample handbag made of plastic strips
- Sample of plastic earrings

4. Moon in decay

This event focuses on bio-waste and the construction of a home composter. The detailed procedure can be found in chapter 7.

If you organize one of the „in the bin" months, we recommend dedicating a bulletin board in your school to this project and gradually adding information/photos/articles/passwords/links. We believe that the project could be of interest not only to the class that will be the main organizer of the event.

Activity 4: Minimalist – game (15 min)

Divide the class into two teams. They can be againts each other or always pairs against each other. It is about practising giving arguments, critical thinking and especially being aware of how much packaging and waste we create in a typical day.

S1 and S2 in the example denote Student1 and Student2, or the whole team of students.
S1 starts by telling about his daily routine, S2 interrupts him with critical questions, which S1 tries to answer in a way that saves the environment and minimizes the generation of waste materials.

S1: I get up in the morning and make tea for the whole family.

S2: So every day you throw a paper and a black tea bag in the trash, actually 4 of them, because everyone gets a cup of tea?

S1: Hm. No, I can get up and make a whole pot. Or I can use dried mint from the summer and it won‘t make any extra fallout, and then I‘ll throw the leaves in the composter.

S2: Excellent. Let‘s move on.

S1: I‘ll have a roll with butter and ham for breakfast.

S2: But that means you bought a roll in a bag, and after the ham there‘s a plastic box left over.

S1: No...

REMEMBER!

The European Union aims to reduce waste materials and emissions and uses various laws to do so. Every individual can help the environment by sorting waste correctly. The primary objective is to avoid waste and, in the case of waste already produced, to implement solutions for its reuse through recycling/upcycling and overall reduction (3Rs: Refuse, Reuse, Recycle).

7. BIOWASTE

Simple composter

A) Introduction to the topic (max. 5 min)

Bio-waste is the abbreviated name for **biodegradable** waste. It is organic residues from our gardens. Bio--waste makes up around 40% of the weight of all waste thrown away and often ends up in the communal waste stream rather than in the brown bins that are designed for it.

From the point of view of the circular economy, bio-waste is a very promising material that could be used as a fertiliser or even an energy source (e.g. electricity, gas). First and foremost, however, we need to focus on its proper sorting and composting.

Bio-waste can be composted in a **vermicomposter** using earthworms, in a conventional compost in the garden or in a shared compost with neighbours. These places and brown bins are always a better option than municipal waste, incinerator or landfill, which produce greenhouse gases due to the lack of air.

B) ACTIVITIES OF CHOICE (11 – 14 years)

Materials (in pairs/groups):

- 1 two-litre plastic bottle, scissors or extendable pruning knife, rubber band, alumini foil (larger than the diameter of the bottle body), sharp pencil or skewer, container with soil, container for scooping soil, bio-waste in a cup (food scraps, leaves, etc.) and the object with which we will scoop the waste, water spray and newspaper.

Activity 1: Bio-waste and its sorting (Theoretical part 15 min)

When taking this quiz, only 1 answer is always the most appropriate.

- What colour is the container for sorting biodegradable waste?
  A) Green
  B) blue
  C) brown
  D) Black

- Approximately what percentage of total waste is bio-waste in the Czech Republic (EU)?
  A) 5 %
  B) 20 %
  C) 40 %
  D) 55 %

- How much of the food grown or produced in the world is not consumed and thrown away?
  A) 1/4
  B) 1/3
  C) 1/2
  D) everything is consumed

- Which of the following is the ideal situation for bio-waste?
  A) Do not produce waste.
  B) Sort waste.
  C) Compost the waste.
  D) Take the waste to the landfill.

- What does the vermicomposter use?
  A) water
  B) earthworms
  C) flowers
  D) special chemistry

- The main advantage of compost is that it is free from landfill is the elimination of greenhouse gases. Which ones?
  A) Oxygen
  B) nitrogen
  C) Methane
  D) Butane

Activity 2: Brainstorming – bio-waste here and now (30 min.)

1. In groups or pairs, draw as many waste bins as possible around where you are. You can then check the picture using an internet map of waste management and discuss the availability or unavailability of individual containers, especially bio-waste bins.

2. Think about today‘s snack. What could go in our composter? Discuss how it works in your home, kitchen, garden. What does/doesn‘t belong in the bio-waste.

3. In groups or pairs, determine which waste belongs to into which waste receptacle.

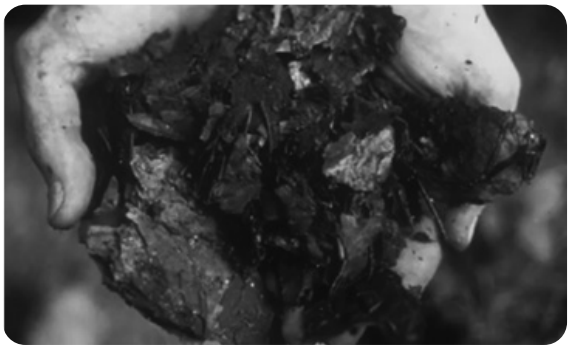
Activity 3: Making a simple composter (practical part 30 min)

1. You can watch a sample video in English and follow it.
   Add this link: *https://raabe.digital/composter/*

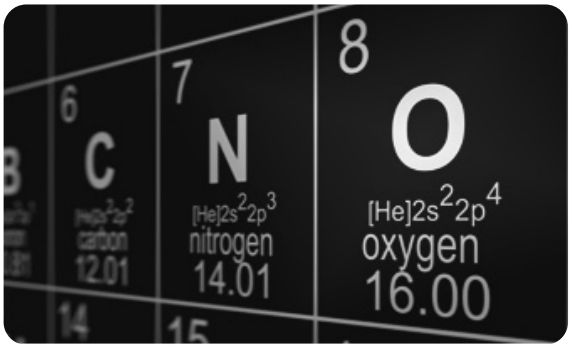
2. Cover the work area with newspaper and prepare all the necessary materials for the group.

3. Stand the bottle up and cut off the neck and throw it away in the sorted waste, or use the cap to make a Jojo toy (see other activities). We will be left with a small home composter.

4. Pour a layer of soil into the composter, then add some bio-waste and spray it with water. If we added too much water, decomposition would not take place and the smell would start to spread. In this case, we add more soil or pieces of newspaper to the compost. If the mixture is too dry, just splash a little water on it.



5. We mix the mixture in the bottle, emphasising the difference between compost and landfill, where no one aerates the evaporated material. In the composter, oxygen-breathing bacteria can survive and decompose the waste without producing methane.



6. Finally, we close the composter bottle with aluminium foil, which we pull over the lid and secure with a rubber band with the help of the team. Punch small holes in the lid with a sharp pencil to allow oxygen to get in. As long as we have not added any unsuitable waste (plastics, meat, etc.), the composter should not smell.

Activity 4: Cross-curricular activities (approx. 15 min each)

Art Education – Describe paintings by famous artists and comment with respect to the theme.

Title: Vertumnus
Author: Giuseppe Arcimboldo
1591, Praha

Zdroj: https://en.wikipedia.org/wiki/Vertumnus#/media/File:Vertumnus_%C3%A5rstidernas_gud_m%C3%A5lad_av_Giuseppe_Arcimboldo_1591_-_Skoklosters_slott_-_91503.jpg

English language – The video is in English, present your own composter and describe how you proceeded, what you needed.

Find a *What Not to Include in Biodegradable Waste at* https://wordwall.net/resource/74226607

Math – Try playing around with a calculator and calculating your carbon footprint to track the possible changes if you change your own behaviour and focus more on sorting and recycling. For example, the GreenOmeter website can help.

Chemistry – Project on Greenhouse gases. What are they and how do they work?

REMEMBER!

Bio-waste is biodegradable waste. It is in society‘s interest to focus on its separation and use composters, vermicomposters or brown bins. Why do we not want bio-waste to end up in landfill? Because it would decompose there without access to air. Greenhouse gases (methane) would be released, odours would be created and the decomposition process would take longer. Another fact is the volume of landfill growing.

Organic waste of plant origin (fruit and vegetable peelings, leaves) belongs in the compost, while animal waste (meat, bones), oils, nappies, etc. have no place in bio-waste.

8. WASTE HIERARCHY, RECYCLING AND REUSE

Waste Hierarchy, Recycling and Reuse

A) Introduction to the topic (max. 5 min)

The waste hierarchy is a key aspect of waste management. If its principles are followed, it will lead to a reduction in the overall production of waste in society.

The creation of new products from waste materials then demonstrates **recycling** practice at an individual level.

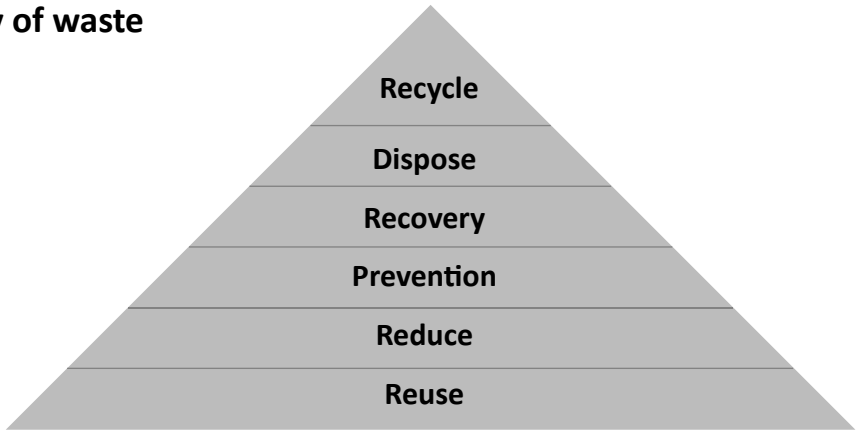
B) ACTIVITIES OF CHOICE (9 – 11 years)

1. **Hierarchy of waste**
2. **Lid Jojo**

Tools and materials:

- plastic caps 2pcs
- skewers 1pc
- cotton
- hot melt gun
- scissors
- nail scissors
- wooden beads 2pcs
- coloured paper or quarter 1pc

1. Hierarchy of waste



In the picture you see **"The Waste Hierarchy"**. Can you explain what the term means?

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You must have noticed that the concepts in the pyramid are shuffled, can you sort them correctly?

Discuss with a classmate what each term means. Write at least a small note on each one.

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Look carefully at the following workflow. What principle from the pyramid is used in it? Remember to justify why.

.....

.....

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.....

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2. Lid Jojo

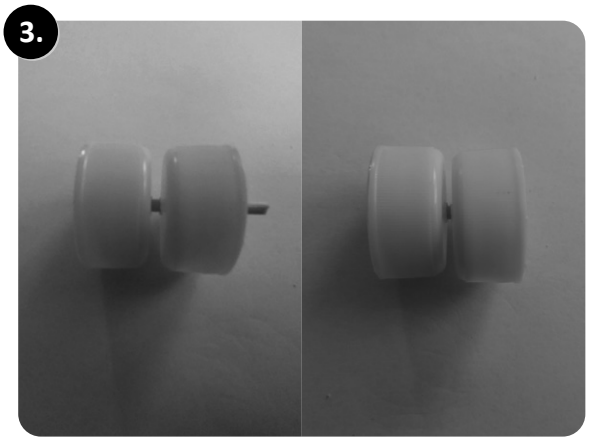
1.

Prepare all the necessary materials and a melt gun.

2.

Using nail scissors, make a hole in the centre of each plastic cap the diameter of the width of the skewer.

3.



Place the lids as close together as possible, threads apart. Push a skewer through them, so that it doesn't extend through the side of the cap. Trim the end of the skewer on the other side.

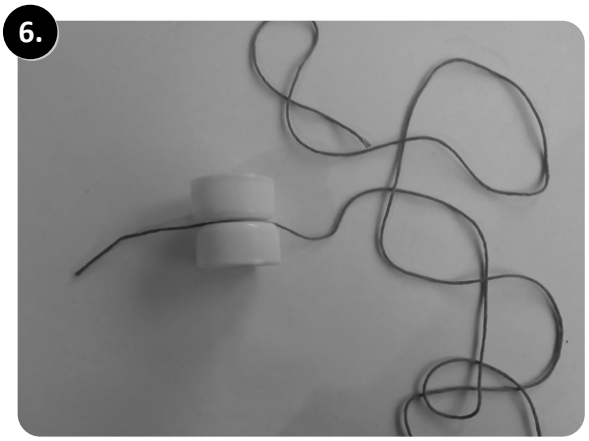
4.

Fix the skewer on the threaded side with a melting gun to prevent the lids from moving and slipping.

5.

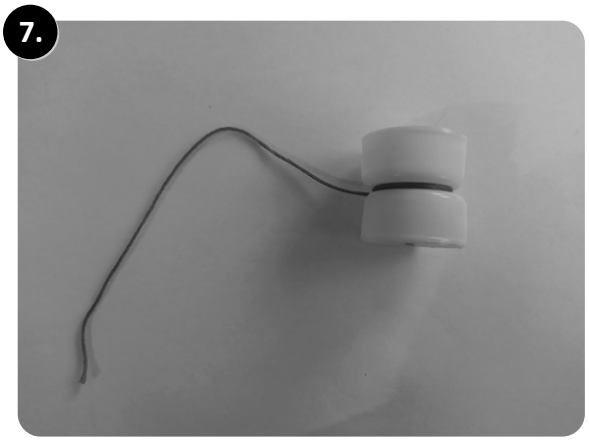
Prepare a piece of cotton from which you cut a piece approximately 15 cm long.

6.



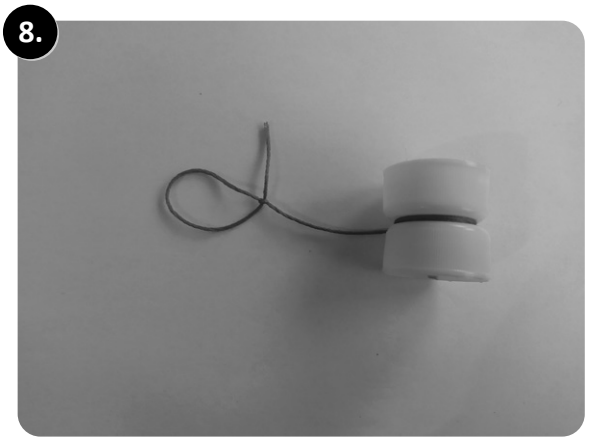
Make a stitch at the end of one side of the cotton, thread it on the middle of the skewer between the eyelids and knot it with one knot.

7.



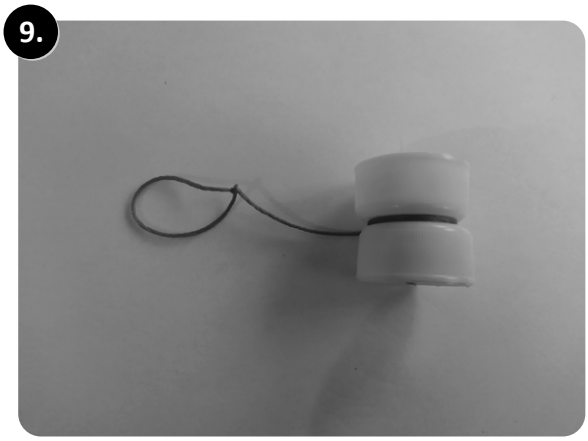
Cut off the shorter part of the excess cotton and wrap the rest of the cotton tightly on a skewer between the lids.

8.



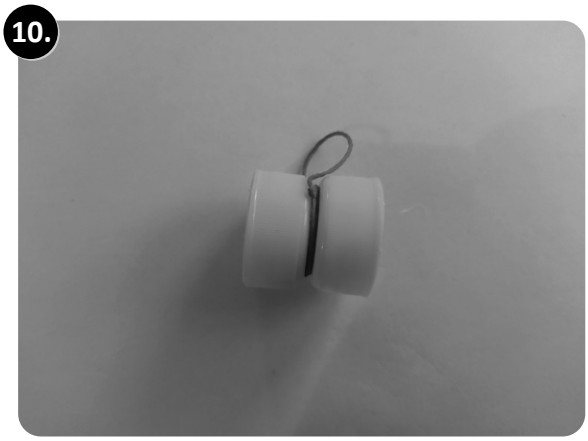
Make a loop at the end of the thread, so that you can put it on your finger and handle the Jojo.

9.



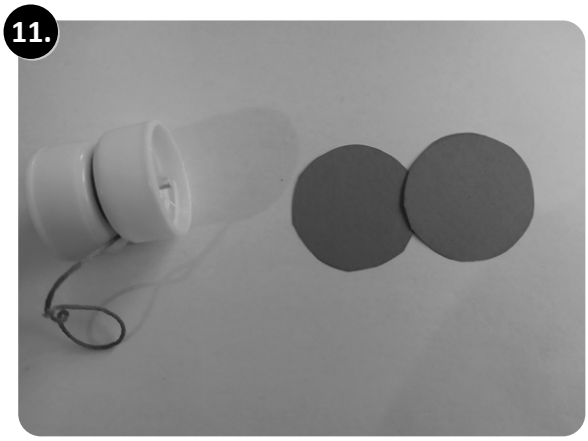
Trim the excess cotton at the stitch so that the knot is not broken.

10.



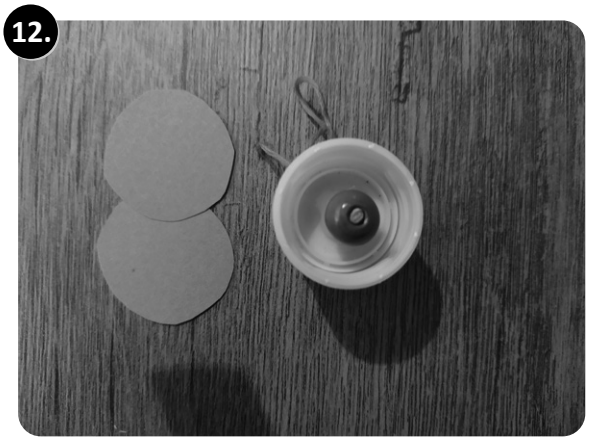
Wrap the rest of the cotton over the formed JoJo.

11.



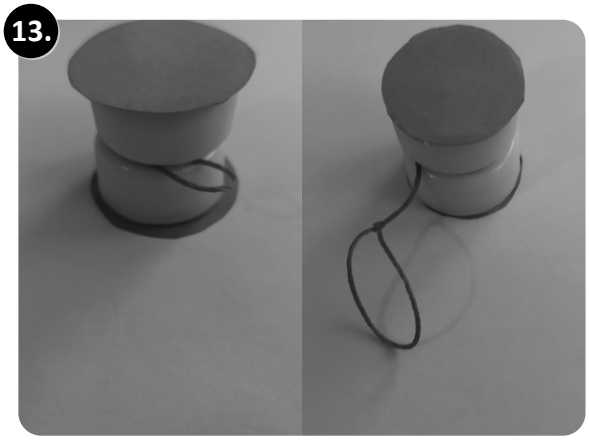
Prepare coloured paper or coloured quarter from which you cut out two circles.

12.



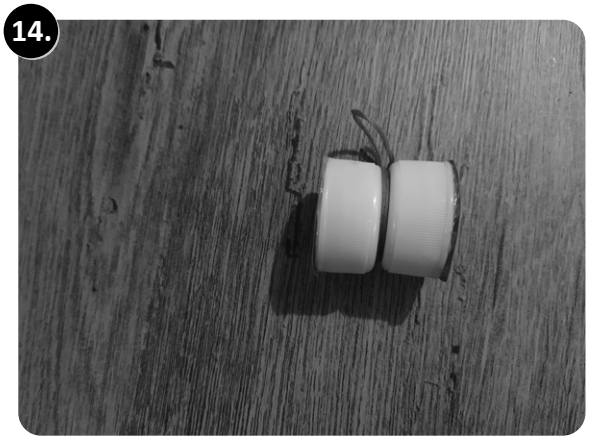
Use two wooden beads and attach them to the sides of the lids on the protruding skewers.

13.



Quickly glue the cut out wheels to the sides of the lid with a hot glue gun so that the yoke closes at the threads. Trim the paper overlaps.

14.



The yo-yo is balanced and closed on the sides, after drying the glue is ready for use. It can be decorated with colours or symbols.

REMEMBER!

A well-applied waste management hierarchy has a positive impact on the reduction of waste generation, ensuring conditions for its reuse and recycling. It determines the possibility of other (e.g. energy) waste and addresses its eventual disposal. The effective managing of these principles has a positive impact on the environment and the amount of waste.

9. BUSINESS FROM AN ECOLOGICAL PERSPECTIVE

A map of the business world from an ecological perspective

A) Introduction to the topic (max. 5 min)

In view of current trends, there is increasing pressure for **green business** – so-called green entrepreneurship. This is particularly the case in Europe, North America and some countries in Asia. This type of business is intended to create a concept for an ideally zero environmental burden. At the same time, green business also incorporates social influences into its concept, thus trying to contribute to economic and social development in the world.

There are several ways to survey the environmental performance of countries around the world, and thus to identify those countries that have the biggest and also the smallest environmental business problems. However, it is important to recognise the crisis situation in some countries and its subsequent impact on the environment.

The following activities are intended to shed light on the importance of green entrepreneurship and at the same time introduce students to rreal data.

Activity 1: Doing business in the world from an ecological point of view (theoretical part, homework, 30 m)

What you need: question sheets, paper, pen, computers, markers, paints, worksheets

1) Divide into 6 groups.
2) Choose a continent (North America, South America, Europe, Asia, Australia, Africa).
3) Divide the questions in the group (separately or in pairs).
4) Using the computer, answer the questions (at home). Do not forget to cite your sources.

Questions:

North America:

1) What can we say about green business in Alaska? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products originating from this country and evaluate whether they are green or not.

2) What can we say about green business in Canada? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and agree whether they are green or not.

3) What can we say about green business in the United States? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

4) What can we say about green business in Mexico? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

5) What can we say about green business in Greenland? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from this country and evaluate whether they are green or not.

6) Record important historical events in Asia that have affected the environment and green business.

South America:

1) Record important historical events in South America that have affected the environment and, by extension, green business.

2) What can we say about green business in the northern part of South America (Colombia, Venezuela, Guyana)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

3) What can we say about green business in the eastern part of South America (Brazil, Paraguay, Uruguay)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

4) What can we say about green business in the western part of South America (Ecuador, Peru, Bolivia)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

5) What can we say about green entrepreneurship in the southern part of South America (Argentine, Chile)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

Europe:

1) What can we say about the green business in Western European countries (France, Germany, the United Kingdom)? Do they have any laws on green business? List some brands from these countries that you can trust to be eco. In contrast, list some brands that claim to be green but are not and why (hint – look at Unile-ver). What do these logos mean? Look for information on the internet.

.ogá na obaloch produktov

Zdroj: Fairtrade.sk/ASC/Rainforest Alliance/Leather Working Group/Leaping Bunny/vecteezy.com/savedolphins.org

2) What can we say about green business in the Czech Republic? Do we have any laws or amendments that regulate green business? List some brands that you can trust to be organic. Conversely, list a few brands that claim to be organic but really are not and why.

3) What can we say about green business in the northern European countries (Finland, Norway, Sweden)? Do they have any laws on green business? List some brands from these countries that you can trust to be green. Conversely, list a few brands that present themselves as green but are not and why (hint: look up Ikea and Romania).

4) What can we say about green business in Eastern European countries (Bulgaria, Romania, Ukraine, ...)? Do they have any laws on green business and do they follow them? List some brands from those countries and evaluate whether they are green or not.

5) Record important historical events in Europe that have affected the environment and possibly green business (hint: look at the topic Industrial Revolutions).

6) What can you tell us about NESTLÉ's green business? Is it really green in every way? Where does the brand come from and what is its history?

Asia:

1 What can we say about green business in Russia? Do they have any laws on green business and do they follow them? List some brands from this country and agree whether they are green or not.

2) What can we say about green business in China? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/statements coming from this country and evaluate whether they are green or not.

3) What can we say about green business in West Asia (Turkey, Iran, Saudi Arabia, ...)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate if they are green.

4) What can we say about green business in India? Do they have any laws on green business and do they follow them? What is the socio-economic climate there and how is the environment affected because of it? List some brands/products coming from this country and evaluate whether they are eco-friendly.

5) What can we say about green business in East Asian countries (Japan, Korea)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate their environmental friendliness.

6) What can we say about green entrepreneurship in Southwest Asian countries (Thailand, Vietnam, Laos)? Do they have any green business laws and do they follow them? What is the socio-economic climate in these countries and how does it affect the environment? List some brands/products from these countries and evaluate whether they are environmentally friendly.

7) Record important historical events in Asia that have affected the environment and green business.

Australia and Oceania:

1) What can we say about green business in Australia? Do they have any green business laws and do they follow them? What is the socio-eco- nomic climate there and how is the environment affected as a result? List some brands/products from this country and agree whether they are green.

2) What can we say about green business in New Zealand? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products that come from this country and assess whether they are green.

3) What can we say about green business in Micronesia? Do they have any laws on green business and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate if they are green.

4) What can we say about green business in Melanesia? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

5) What can we say about green business in Polynesia? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

6) Record important historical events in Australia and Oceania that have affected the environment and, by extension, green business.

Africa:

1) Record the important historical events in Africa that have affected the environment and green business.

2) What can we say about green business in West Africa (Sudan, Ethiopia, Somalia, Kenya, ...)? Do they have any laws about green business and do they follow them? What is the socio-economic climate there and how is the environment affected as a result?

3) What can we say about green business in North Africa (Morocco, Algeria, Tunisia, Egypt, ...)? Do they have any green business laws and do they follow them? What is the socio-economic climate there and how is the environment affected as a result? List some brands/products from these countries and evaluate whether they are green.

4) What can we say about green business in Southern Africa (Angola, Zambia, South Africa, ...)? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products coming from these countries and evaluate whether they are green.

5) What can we say about green business in East Africa (Mali, Senegal, Ivory Coast, ...)? Do they have any green business laws and do they follow them? What is the socioeconomic climate there and how is the environment affected as a result? List some brands/products coming f r o m these countries and evaluate whether they are green.

Activity 2: Elaboration of knowledge about continents, production of continents map (Practical part – 40 min)

What you need: elaborated worksheets, map of continents, markers

1) Get into the same groups as in action one.
2) Discuss your answers to the questions you have been working on.
3) Write down your thoughts (the most important things you have learned) on the continent map.
4) Select one presenter.
5) Present your findings to the rest of the class.
6) With all the groups together, create a world map.

REMEMBER!

Eco-friendly business, also known as green business, is not only a trend of our time, but is also very important for maintaining a healthy environment and is therefore crucial for a better future. Green entrepreneurship is a concept to reduce environmental burdens. This means that it seeks to ensure that business has a minimal, ideally zero, impact on the environment.

One of the main tasks of green business is to reduce production waste and harmful emissions. At the same time, however, it is also concerned with the impact on people. This means that it seeks to contribute to social and economic development and the creation of good working conditions. The green economy seeks to change the current linear economy into a circular economy.

Figure 1 – Linear economy

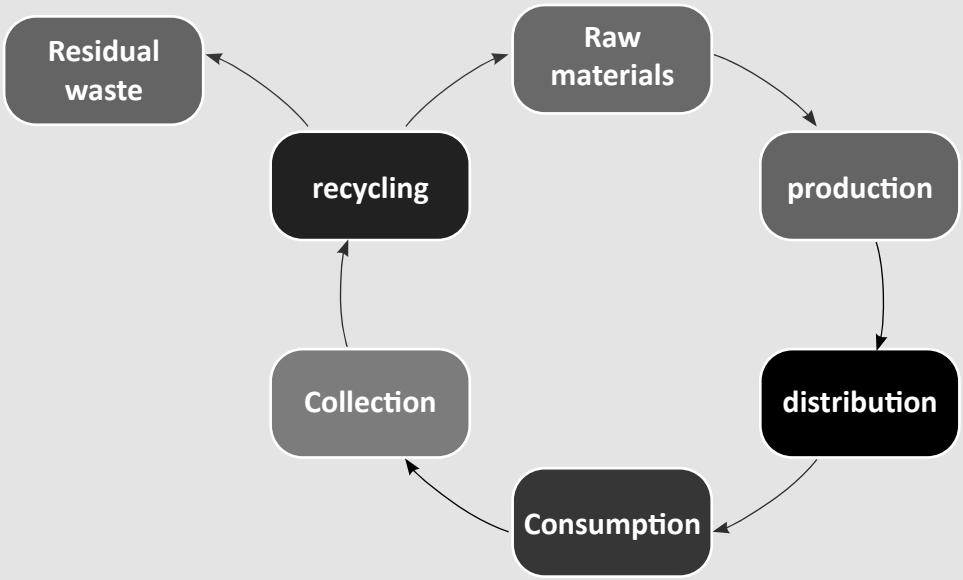


Figure 2 – Circular economy

It is important to contribute to the improvement of the environment, even as an individual, and therefore to use as many green business practices as possible. We can do this, for example, by wearing eco-friendly clothes; washing when the washing machine is full and using the right detergents; in cities, preferring public transport to cars or cycling; encouraging composting and recycling; ...

Last but not least, it is very important to verify information. The ideal is to really look to see if the company or brand that is masquerading as „green“, really is ecological.

10. THE RELATIONSHIP BETWEEN NATURE AND CIVILISATION

Wild animals living in our forests, how to behave in the forest

A) Introduction to the topic (max. 10 min)

When walking in the countryside, you will certainly notice the wildlife. You can meet many **species** here, probably the most famous is the roe deer, but also the European deer, red fox, common wolf, wild boar and many other species. Last but not least, the Brown Bear can be dangerous to us humans.

- Wild animals are shy, as a rule they avoid all humans.
- If we behave quieter in nature, we may see some species, usually on the range.
- Much more often we can come across **game tracks**, usually prints on the ground.
- In spring, we can even see young animals, most often roe deer.

We can see wild animals not only in the zoo, but if we behave quiet even in the wild. Wild animals usually have no natural enemy in the form of predators, so their numbers need to be regulated. For this purpose we have hunters who regulate the numbers of wild game by controlled hunting. At the same time, humans greatly influence the natural structure of the diet that wildlife can find for itself in nature. For this reason, particularly in the winter months, some game species have to be overfed.

B) ACTIVITIES OF CHOICE (10 – 15 years)

Activity 1: Creating a game survey (15 min)

Materials:

- ✓ blackboard – or alternative with a similar meaning, writing utensils, computing device with internet access (PC, tablet, phone).

Task:

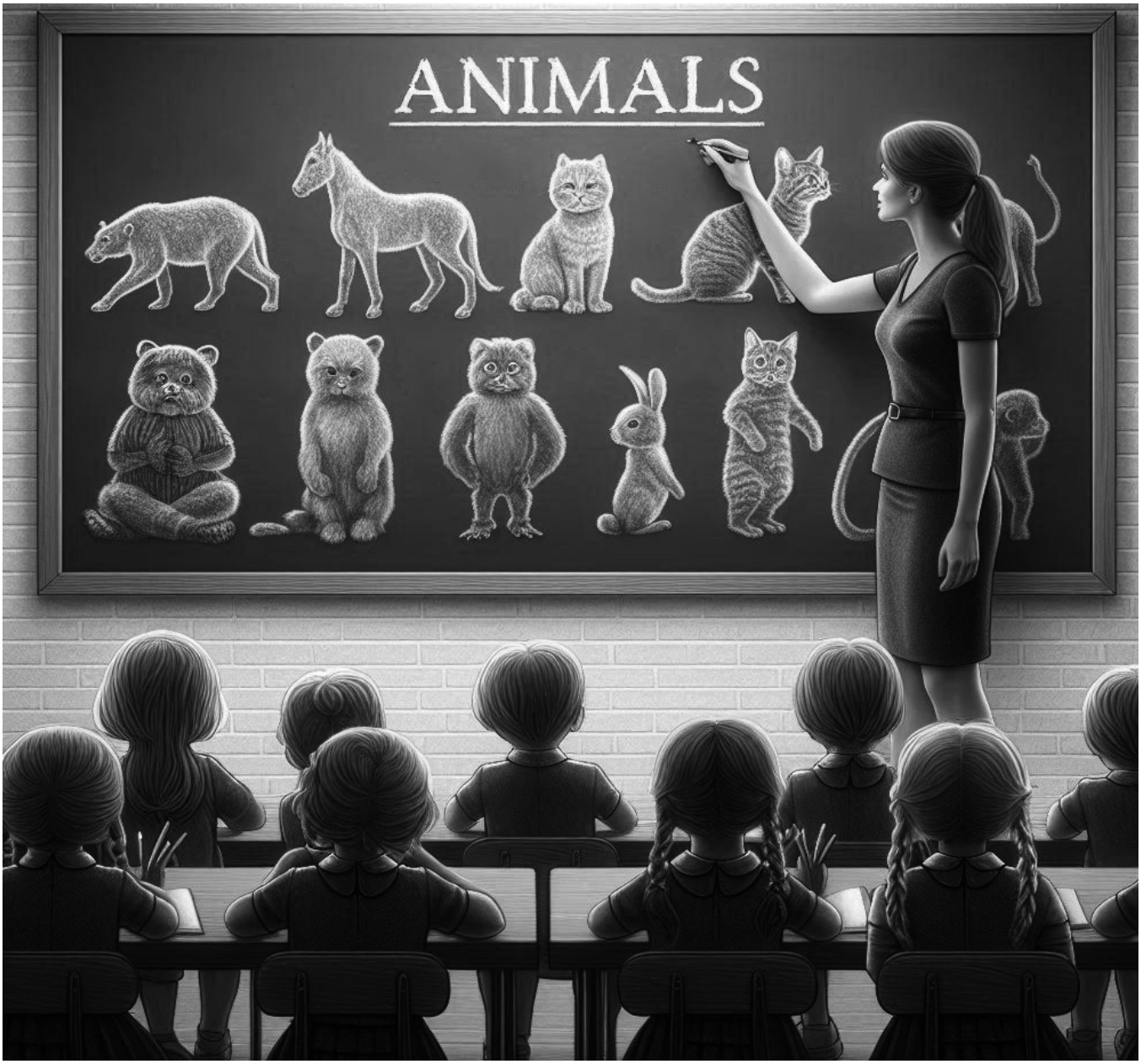
Surely each of you at some point in your life visited a zoo. What have you seen there?

- Try to name the species of game you have seen together and write them on the board.
- When you have written down everything you have seen, try to distinguish which animals you can see in our forests and add any other species you can think of to the board.

Probably you will find out that in the zoo you will not meet many species of game that lives in our forests. You can also use the internet to find species of game that live in our forests.

REMEMBER!

Above all, remember the different species of game you can find in the countryside around you.



Activity 2: Wildlife Recognition (20 min)

What you need:

- ✓ blackboard – or alternative with a similar meaning, writing utensils, computing devices with internet access (PC, tablet, phone) or textbooks for hunting.

Task:

We now know what wild animals live in our forests. Let's try to name them according to the pictures. You can use the list of wild animals you wrote on the board earlier as a guide. Aren't you sure? You can use the Internet as a hint.

You can write titles for each picture:

1. 

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2. 

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3. 

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1. 

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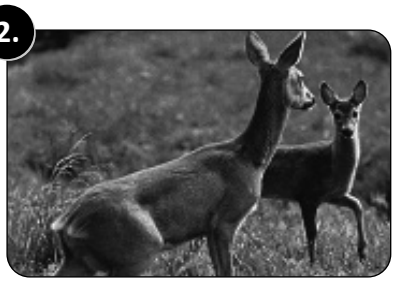
2. 

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3. 

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1. 

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2. 

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Source: ČERVENÝ, Jaroslav, 2004. *Encyclopedia of hunting.* Prague: O ttovo nakladatelství v divizi Cesty. ISBN 80-718-1901-8.

REMEMBER!

Memorize the appearance and name of all depicted game species.

Activity 3: Recognition of wildlife tracks (20 min)

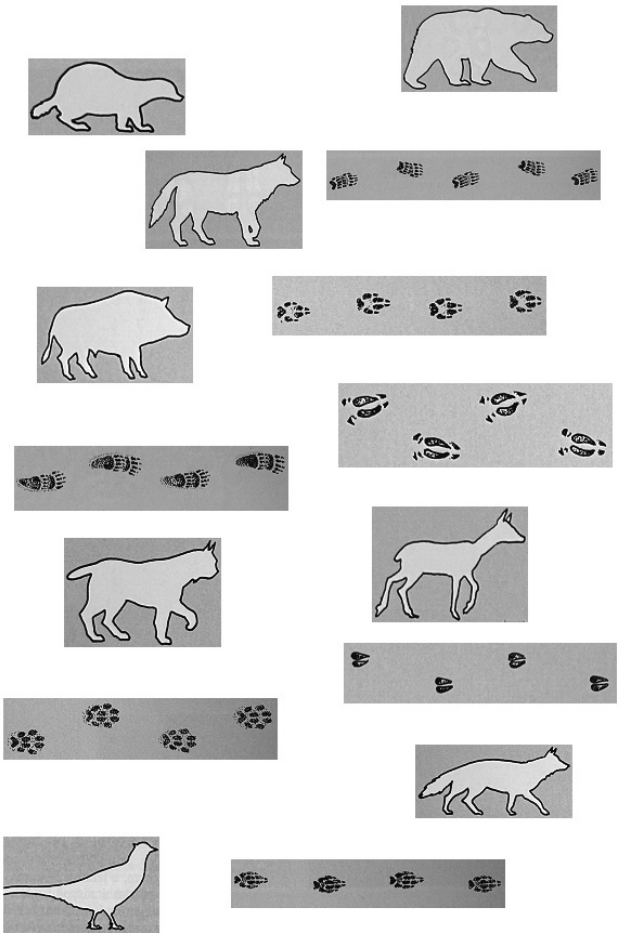
Materials:

- ✓ blackboard – or alternative with a similar meaning, writing utensils, computing devices with internet access (PC, tablet, phone) or textbooks for hunting.

Task:

Now we can name the animals and we can recognize them. If we go out into nature and see a footprint on the ground, for example in the snow or soft ground, can we recognise which animal the footprint belongs to?

The following pictures show game tracks and the silhouette of the game you learned to identify and name in the previous activity. Try to use lines to connect the pictures of tracks and game that belong together. Are you not sure? You can use the Internet to help you.



REMEMBER!

Memorize the appearance of the game tracks, and what kind of game they belong to.

Activity 4: Feeding wildlife (20 min)

What you need:

- ✓ blackboard – possibly an alternative with a similar meaning, writing utensils, computing device with internet access (PC, tablet, phone) or textbooks

Task:

During the winter months, it is harder for animals to find food. This is especially true for roe deer, deer, fallow deer and other game. For the purpose of feeding, hunters have feeding devices called feeders, into which they properly put food, would you know what is appropriate to add to the feeder and what does not belong there? Are you not sure? You can use the internet to help you.

In the table below, write down the types of food that can be fed to game and those that cannot be used:

	Suitable feed for the feeder:	**Food that doesn‘t belong in the feeder:**
Types of feed:		

REMEMBER!

You can add the food that belongs to the feeder to the feeder yourself in small quantities. Do not put food that does not belong in the feeder under any circumstances! You can also arrange with hunters in your area to help with the feeding.

Activity 5: School trip – excursion (5 min – discussion of the topic of the trip)

Materials:

- ✓ data projector, digital maps, or a computing device with internet access (PC, tablet, phone) for students. According to the subsequent realization, suitable transport will be arranged.

An idea for a school trip:
If you have nature close to your school, you can go into the countryside instead of staying at school. You will have to behave ??higher and then you might see some of the animals you learned about earlier.

Methodological guidelines
Activity 1: Individual contributions of pupils in class, the teacher gradually lets the pupils write their contributions on the board. The teacher assists the pupils with appropriate help. The teacher guides the pupils‘ debate.

Activity 2: Pupils individually write the names of the species for the pictures. The teacher continuously checks for correctness, and depending on the situation, can help the pupils with identification and correct names. The goal is to correctly identify the name and appearance.

Activity 3: Pupils individually link pictures of tracks and pictures of animals with a pencil (for correction). The teacher checks continuously for accuracy, depending on the situation, can help the pupils with identification and correct names. The aim is to correctly link the picture of the game and the track.

Activity 4: The teacher has the students individually write their contributions in a table. He/she assists pupils with appropriate clues and supervises the appropriate recording of the types of food in the table.

Activity 5: The length of the walk and its organisation depends on the school‘s disposition. The teacher can plan the event himself, the time scale will be 2 x 45 min.

Core competencies:
Group work will develop key competences, especially social and communication competences. Furthermore, according to the specific task, there will be development of digital competence, imagination, ability to analyse text and critical thinking.