Experimento | 4+

Experimentation instructions

Experiments suitable for children between 4 and 7 years of age.
Use only under supervision.

Foreword

Enthusiasm and curiosity offer the best conditions to kindle the interest of children around the world in nature and technology at an early age and nurture it across all age groups. At the same time, however, the demands on teachers and expectations for STEM education continue to grow. Science, technology, engineering, and mathematics are rapidly shaping and redefining our world. More than ever, the future of our global development depends on young people who feel at home in the digital world of today and tomorrow and know how to engage with it responsibly and constructively. This requires students to acquire a real-world understanding of technology and skills for social interaction as early as possible. We need to prepare them for careers that we are not yet even aware of today.
Our **international education program Experimento** demonstrates our commitment to an impact-oriented science and technology curriculum that challenges students' individual potential from preschool til graduation.

Experimentation, establishing interrelationships, interpreting phenomena!
Experimento

- is geared toward teachers in preschools, elementary schools, middle schools, and secondary schools;
- offers around 130 specifically developed experiments for the age groups 4 – 7 (Experimento | 4+), 8 – 12 (Experimento | 8+), and 10 – 18 (Experimento | 10+);
- offers a diverse, curriculum-oriented, classroom-friendly selection of topics exploring a wealth of topics relating to health, energy, and the environment;
- is based on the idea of inquiry-based learning and "acquiring knowledge actively"; and
- is focused on the regions of Africa, Latin America, and Germany/Europe.

The 37 experimentation ideas of Experimento I 4+ were developed by a team of experts from the Foundation "Haus der kleinen Forscher" (Little Scientists' House) and prepared for international use. The experiments accompany children on their research and discovery journeys and enable early basic insights: What does it take to make an incandescent lamp light up? What does the inside of our body look like? Can we see water pollution?

All experimentation instructions, along with many other tips, are also available in digital format at our **Media Portal for STEM education**. The materials are provided under an open license as Open Educational Resources (OER), so they can be freely downloaded, modified, and shared. Today's increasingly diverse classrooms lend new urgency to the need for teachers to adapt, individualize, and creatively enhance materials to accommodate special teaching and support needs.

We are very pleased that you are committed to strengthening science and technology education with Experimento | 4+, and we wish you much success!

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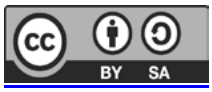
Foundation “Haus der kleinen Forscher” (Little Scientists’ House)

3rd updated edition 2018



As a nonprofit foundation, we promote sustainable social development, which is crucially dependent on access to basic services, high-quality education, and an understanding of culture. To this effect, our project work supports people in taking the initiative to responsibly address current challenges. Together with partners, we develop and implement solutions and programs to support this effort, with technological and social innovation playing a central role. Our actions are impact-oriented and conducted in a transparent manner.

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General information

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Pedagogical basics

Children and educators define the learning process together:

- Children create their own picture of the world. Educators accompany them on this path.
- Good educators make it possible for children to gather a wide variety of experiences and support children in the learning process.
- Children also learn with and from one another and exchange ideas.

Children are aware *that* they are learning something:

- Together, educators and children not only address content and activities, but also reflect on the learning process.
- The documentation of experimentation activities through drawings, photos, video recordings, and similar tools supports the children's learning process.

What practices are most important when researching and experimenting?

Enter into the world in which children live!

Every activity with scientific and technical topics starts from the world in which the children live. Take up the questions the children ask during the process. Wherever possible, the experimentation is linked with other fields of education and presented in terms of larger contexts.

Build on what the children already know!

Pay close attention to when children talk about their experiences, observe them, and ask questions about their assumptions.

Talk with the children!

Dialog helps children move on to the next stage of development. That is why it is better not to explain too much, but to ask the children about their ideas and associations.

Encourage the children to think!

It is not a problem if children initially express a supposedly "wrong" idea. From time to time make the children aware of things that do not fit in with their assumptions. In this way, you will encourage the children to question their concept, adapt their idea, or even to come up with a new theory on their own.

Additional literature on the topic:

Fthenakis, W. E., Wendell, A., Eitel, A., Daut, M., Schmitt, A. (editors.): Natur-Wissen schaffen.
Volume 3: Frühe naturwissenschaftliche Bildung. Bildungsverlag EINS, Troisdorf 2009.

Haus der kleinen Forscher (Little Scientists' House) foundation (publisher): Pädagogischer Ansatz der Stiftung "Haus der kleinen Forscher". Anregungen für die Lernbegleitung in Naturwissenschaften, Mathematik und Technik. Berlin 2013.

General safety and hygiene measures

- Utensils that you need for carrying out experiments with the children should not be used for any other purpose. That applies to all utensils but in particular to plastic cups, containers, etc. as well as food.

- Make sure that children with long hair wear it tied back and that the children's clothing is not too loose (especially sleeves).

- You should generally point out to the children that they should not eat or drink anything while they are carrying out experiments. Exceptions are possible but only if you specifically waive this rule.

- Make sure that containers with chemicals (e.g., ink) or other materials for experimenting (sugar, cooking oil, as well as trash, etc.) are always precisely labeled and clearly marked as experimentation material. That applies in particular if you or the children transfer material into other storage containers.

- Talk to the children about potentially dangerous materials and explain to them how to handle these substances safely.

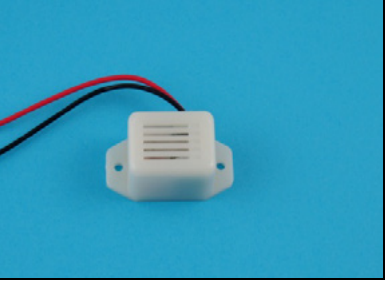
- Label the containers with dangerous or toxic substances using appropriate symbols.

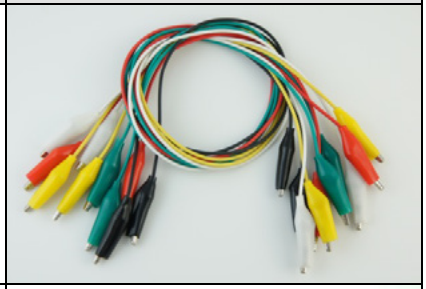
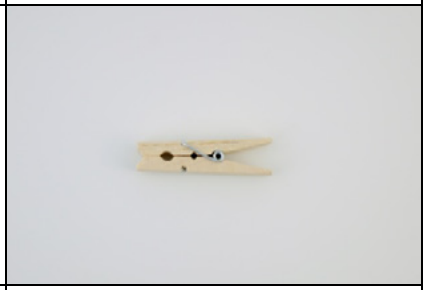
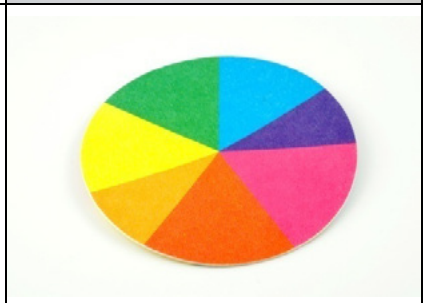
- The existing safety information should be discussed and if necessary you should draw up new information and instructions together.

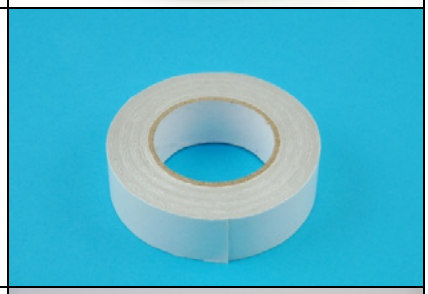
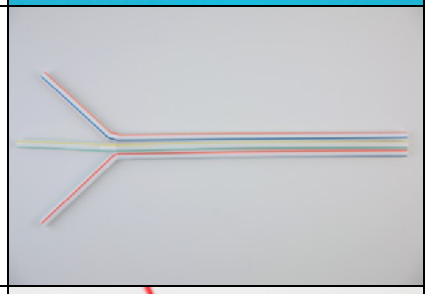
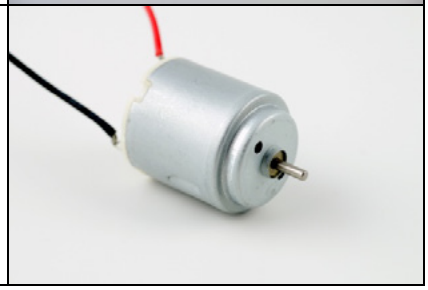
- Individuals' right of self-determination must be respected: Our body and the way we treat it is a highly sensitive and personal matter. Respect the children's right to decide for themselves about issues to do with the body. Make sure that children only touch each other (for example, taking their pulse) or listen to internal body sounds with a stethoscope if both of them agree. Respect that a child may not wish to try a certain food, pull up their trouser leg, etc.

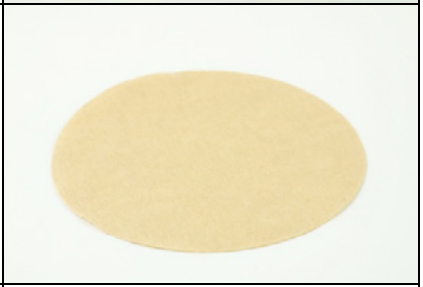
- Note concerning the tubular bandage: You can wash the tubular bandage used for experiments relating to digestion if it gets dirty.

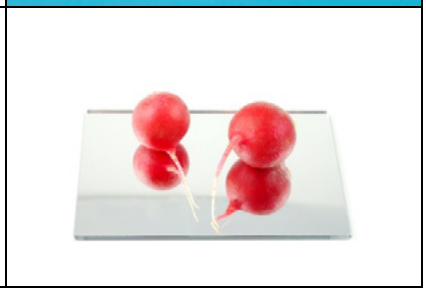
Material, sorted alphabetically

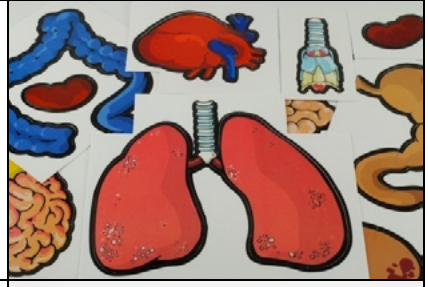
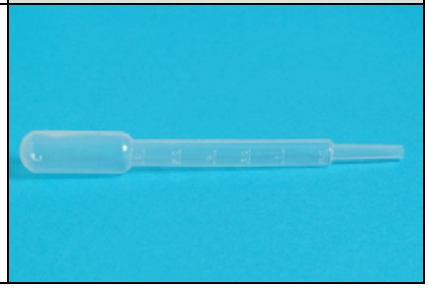
Material	Quantity	Box	
aluminum foil roll	1	loose in the kit	
balloon, red	30	8	
battery AA, 1.5 V, LR6	30	5	
battery holder for 3 AA batteries	10	5	
bottle plastic 250 ml	5	10	
buzzer 2 V – 4 V	10	1	

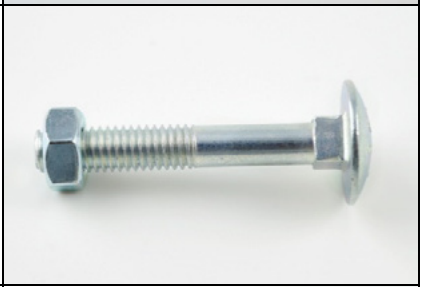
Material	Quantity	Box	
cable with alligator clips	40	3	
cloth bag	1	8	
clothespin	40	6	
color wheel	10	11	
cord, white	1	8	
cork tile length 25 cm width 15 cm height 1 cm	5	11	
cork tile length 25 cm width 15 cm height 1 cm	5	12	

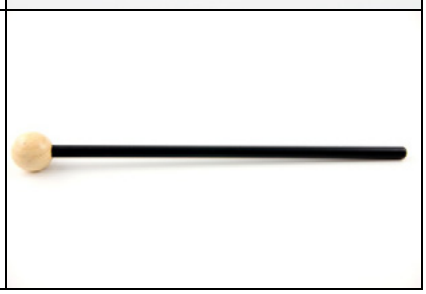
Material	Quantity	Box	
cotton, 50 g	1	4	
crayon	12	7	
cream 75 ml	1	6	
double-sided adhesive tape roll	1	6	
drinking straw	100	13	
electric motor for battery operation with an axle 0.4 V, 25 milliamperes	10	1	

Material	Quantity	Box	
film canister	10	4	
filter paper diameter 12.5 cm	100	13	
flashlight	3	10	
glue stick	1	7	
hook	10	6	
incandescent lamp clear 2.5 V with socket	20	1	

Material	Quantity	Box	
ink, blue bottle 50 ml	3	3	
laundry sprinkler plastic 300 ml	3	loose in the kit	
magnifying glass 3X diameter 5 cm length 15 cm	10	10	
masking tape roll	2	13	
measuring cup plastic 100 ml	20	9	
mirror	10	6	

Material	Quantity	Box	
nail	100	3	
organs, set of pictures	3	14	
paper clip 50 mm	20	11	
paper, red	10	14	
pencil sharpener metal	1	7	
pipette plastic length 14 cm	10	2	

Material	Quantity	Box	
plastic wrap roll	1	loose in the kit	
scissors, left-handed	2	2	
scissors, right-handed	8	2	
screw	10	3	
sidewalk chalk	5	7	
spoon small metal	10	8	
stethoscope	1	11	

Material	Quantity	Box	
string roll	1	11	
tubular bandage roll	1	loose in the kit	
wooden dowel	10	3	
wooden mallet	2	6	

Note: The illustrated experimentation materials may differ from the materials in the kit.

How do I use the Siemens Stiftung Media Portal?

The Media Portal contains some 3,500 teaching materials (as of April 2018) in English, German, and Spanish on topics relating to science and technology, including the experimentation instructions for Experimento. All the materials are available as Open Educational Resources (OER) under an open Creative Commons license, so they can be downloaded, modified, and shared without prior registration.

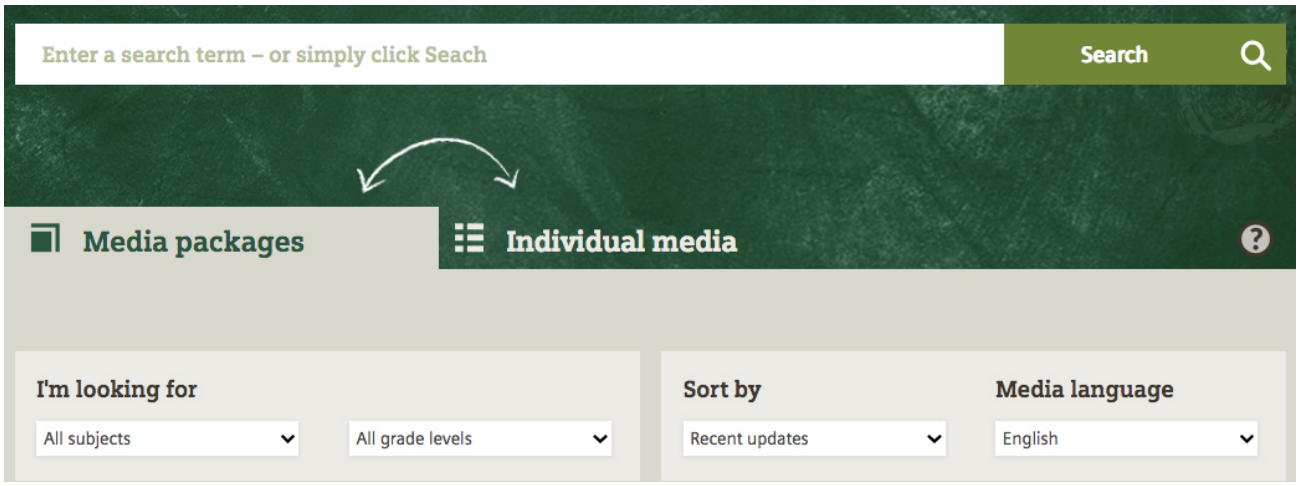
Guaranteed open: all media are OER

The OER on the Media Portal are generally available under the “CC BY-SA 4.0 international” license. CC stands for Creative Commons, the nonprofit organization that developed a workable licensing model for open media. This license grants users the following rights to the media:

- Modify – rewrite texts, add new graphics to a worksheet, etc.
- Remix – combine two Media Portal graphics, for example
- Share worldwide – online or in hard copy (including in modified form)

The conditions are that users must give appropriate credit to the author, indicate if any changes were made, and distribute the media under the same license as the original (learn more at: https://creativecommons.org/licenses/by-sa/4.0/deed.en).

1 Media page



From the Media Portal homepage use the search box or click the “Media” link in the top navigation to go to the media search engine. There you can search for individual media – images, interactive graphics, videos, worksheets, experimentation instructions, link lists, audio files – or entire media packages by specific criteria such as subject, grade level, language, or media type. Smart search features help you quickly find what you’re looking for.

The “Individual media” tab shows a list of standalone media, while the “Media packages” tab directs you to bundled teaching materials relating to a larger topic. Media packages generally also include handouts for using the media in the classroom. You can download individual media and media packages right away or preview them in the detailed view, which includes information on their content, possible areas of use, learning resource type, author, and license.

Bookmark lists: save, edit, share teaching materials

You can manage the Media Portal content using personalized bookmark lists. This feature lets you group together teaching materials into lists that you can later view, download, or easily share with colleagues or students. You can give the lists your own name and title, add notes for the user, and once you share it specify an end date for the sharing. You can create as many bookmark lists as you like, add and remove individual media, and empty or even delete entire lists. To use the bookmark list feature, you must first register (see section 5).

Share: information and collaboration made easy

You can share media, media packages, and bookmark lists with your fellow teachers or with your students. You have the option to share lists using a hyperlink or QR code for direct access in the classroom or integration into documents, presentations, handouts, etc.

Media for students

A separate student area offers a selection of media on the topics of health, energy, and the environment that students can browse, try out, or play around with. Students can also use these materials for individual study. In media search results, these media are marked by an orange splash icon so you can see at a glance that they are appropriate for independent study units.

2 Teaching methods in theory and practice

Click “Methods” in the top navigation to learn more about exciting methods and models for teaching science and technology. Education and media experts offer clear and concise presentations on methods such as service-learning and research-based learning. They also provide background into learning theory and point to studies on learning effectiveness and literature for further study. Practice-oriented teaching examples provide tips for applying the methods. For some methods, you’ll also find links to advanced training opportunities such as web-based trainings. If you wish to take advantage of the advanced features such as saving your progress across sessions or participating in forums, we recommend registering with the Media Portal (see section 5).

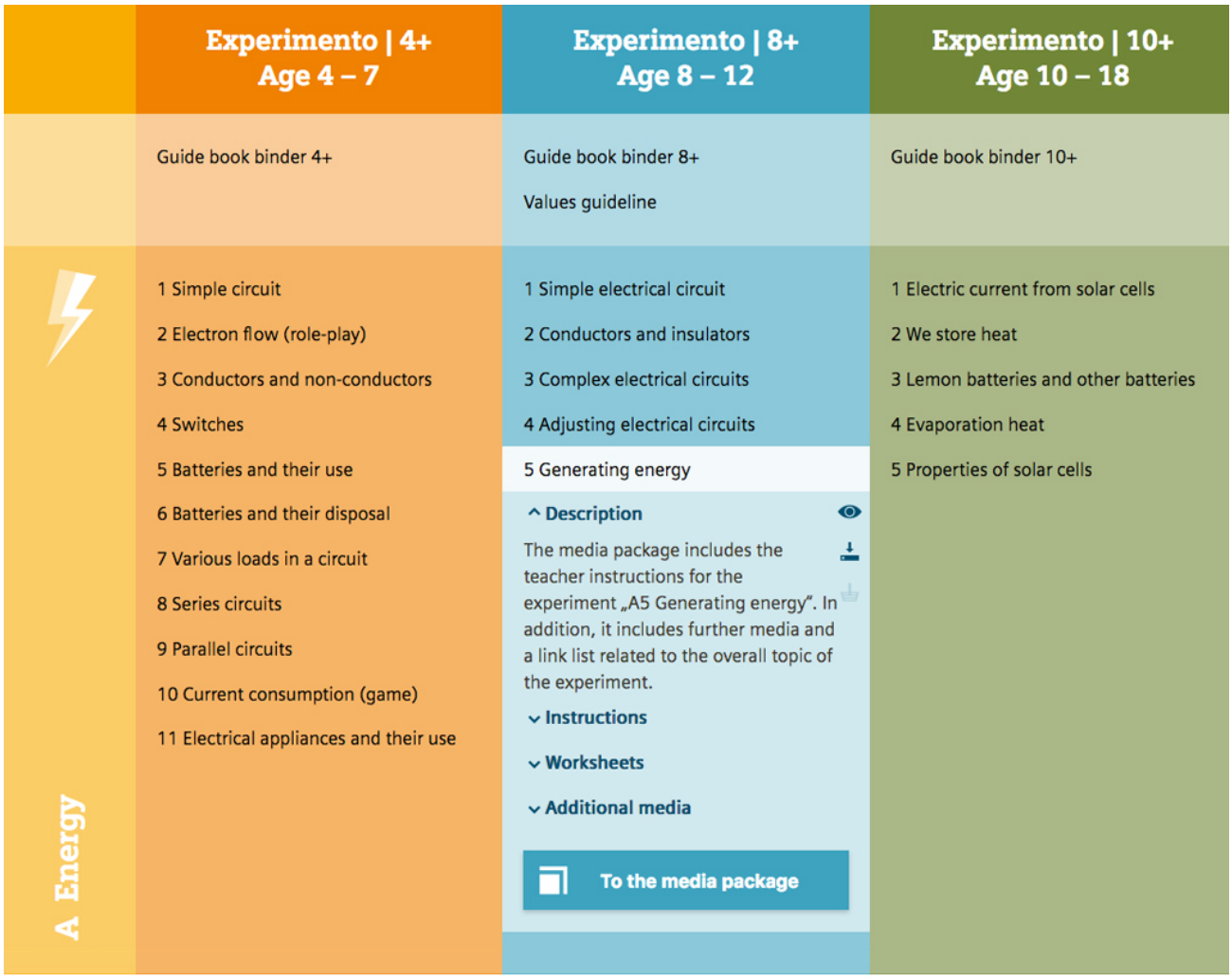
3 Events, new media, newsletter

Our homepage provides regular updates on new media and the latest studies, events, and platforms relating to OER, education, and STEM. To make sure you don’t miss any news, simply sign up to receive our free newsletter, which is published three times a year (see section 5.5).

4 Experimento at a glance

From the homepage, scroll down to the Experimento section and click on the link **“All Experimento media can be found here”** to reach the Experimento-matrix.
Here you can see all available experiments on energy, the environment, and health at a glance, sorted by the age groups of 4 – 7, 8 – 12, and 10 – 18.
Click on any experiment to display a description of its media package and an overview of available instructions and additional media – worksheets, animations, images, etc.

Direct link to Experimento-Matrix: https://medienportal.siemens-stiftung.org/experimento_matrix

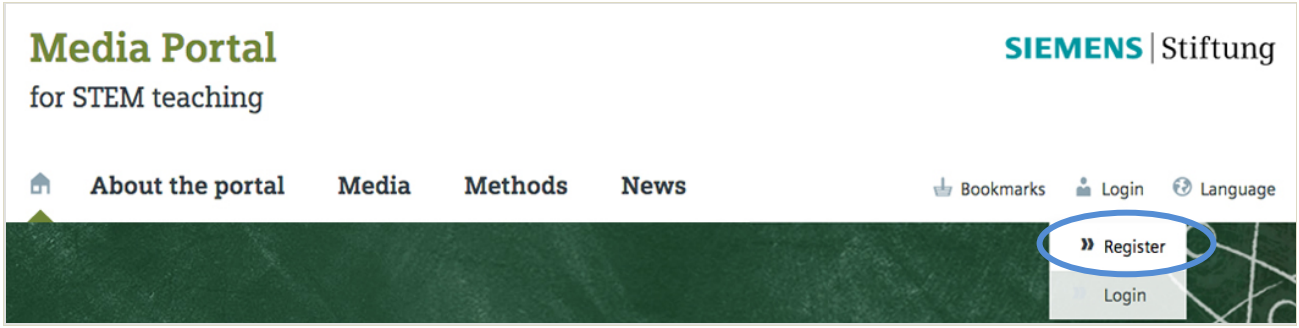


5 Registration step by step

Users can access all the Media Portal content without registration, but registering makes it possible to benefit from advanced features that include the ability to create, share, and unlock bookmark lists (see section 1), save your progress in web-based trainings across sessions, and use other extended functionalities of the digital education offerings. Registering also allows you to subscribe to our Media Portal newsletter.

5.1 Step 1

Hover over "Login" in the top navigation, then click "Register". This opens a page where you can enter your data.

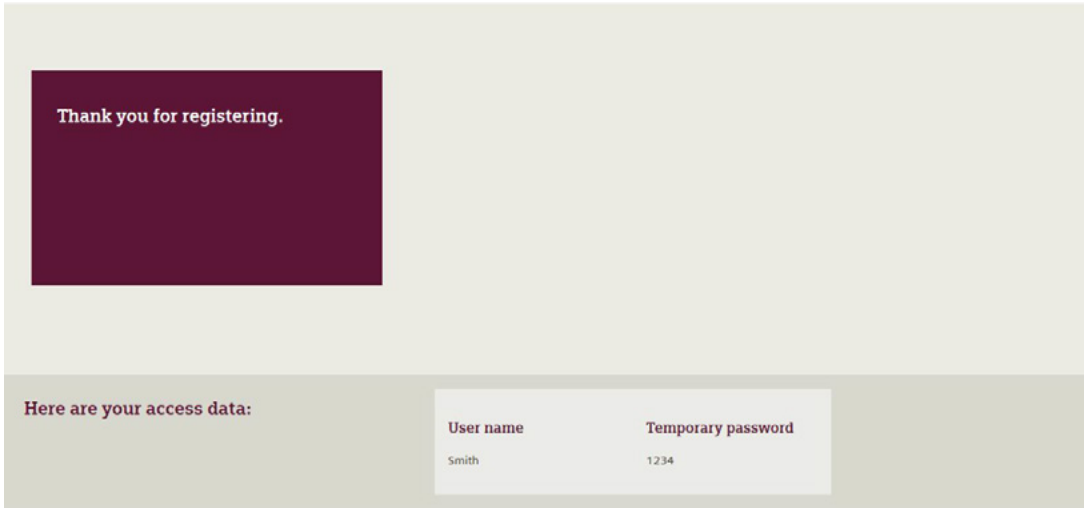


5.2 Step 2

Fill in the registration form. Fields marked with * are mandatory. Carefully read the Terms and Conditions and Privacy Policy. Mark the checkbox to declare your consent, then click "Submit".

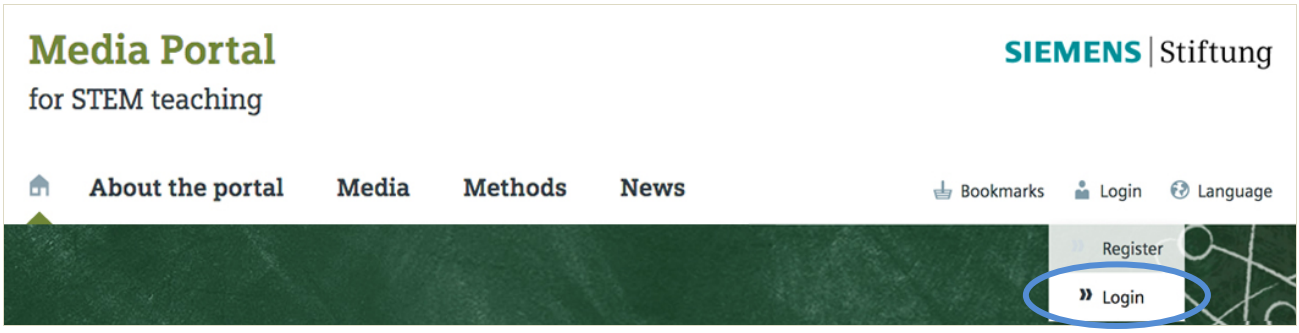
5.3 Step 3

Your user name and temporary password will then be displayed. Please make sure to note this data before you close the window so that you can log in the first time. **Attention: Your login data will not be sent to you by email!**



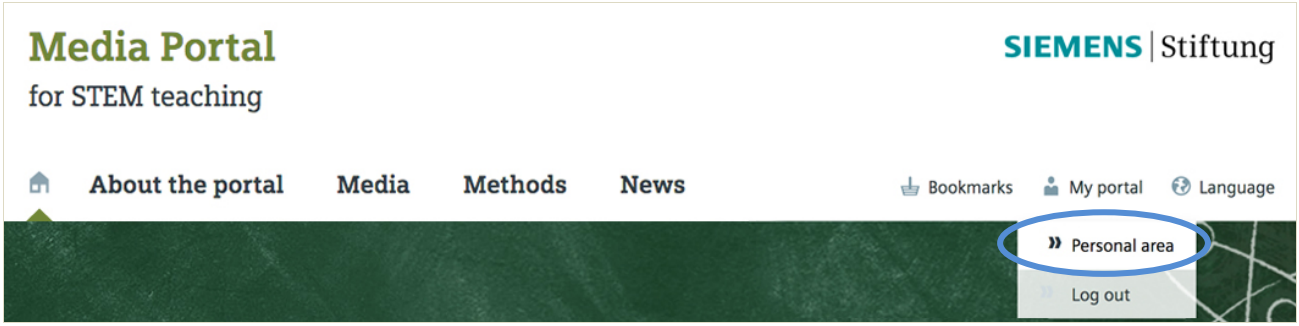
5.4 Step 4

Now you can access the Media Portal by clicking “Login” in the top navigation and entering your user name and temporary password.



5.5 Step 5

Once you have logged into the Media Portal the first time, hover over the “My portal” link in the top navigation, select “Account settings”, then click the “Change login details” button to select a user name and password of your choice. The ”Account settings” page also provides a link for changing your personal data and subscribing or unsubscribing to our newsletter.



We hope you enjoy the Siemens Stiftung Media Portal!

We welcome your questions or suggestions:
medienportal@siemens-stiftung.org

Instructions Energy

Introduction to the topic of energy

Our need for energy is growing and growing: Whether it is our refrigerators, televisions, or computers – the simple convenience that electrical devices provide is as central to our day-to-day lives as the cars we take for granted. At the same time, however, resources are dwindling and the consequences of climate change are forcing us to think differently. That is why we need fresh solutions and thoughtful actions when it comes to power generation and consumption. Part of the solution is to help children develop an early understanding of the basic issues surrounding energy.

The experimentation instructions of Experimento I 4+ are designed to teach children where electrical energy plays a role in their day-to-day lives. They will explore phenomena such as “Electricity flows in a circuit” and “Electricity is consumed” and learn the basic architecture and various elements of an electrical circuit. Last but not least, the experiments focus on the use and proper disposal of batteries.

The instructions do not specify a particular order, but “Electricity flows in a circuit” is a good place to start, especially with younger children. That enables basic experiences that could provide helpful prior knowledge for the other experiments. The list of materials is designed for groups of three to four children.

Safety information on the topic of energy

The children may conduct the experiments only under educator supervision.
The educator should point out to the children that the provided materials may be used only according to the respective instructions.
Observe the following safety information as well as the applicable safety guidelines for your institution and discuss them with your children.

Safety-relevant materials and apparatus must be tested for proper functioning before being handed out to the children.

Power sockets

Carrying out experiments with the supplied batteries is not dangerous. However, electric currents can also be felt and at high powers they can be life-threatening. It is therefore important to ensure the children understand that they must not under any circumstances experiment with power sockets.

Storage of battery holders

Batteries can cause a short-circuit if they make incorrect contact in the battery holder or if the battery holder's contacts accidentally make incorrect contact. The batteries then discharge, become hot and can even start a fire. Therefore, always remove the middle battery from the battery holders when they are not in use and close the battery holders with the covers provided.

Avoiding short-circuits

Make sure that the children do not accidentally create short-circuits. A short-circuit occurs when there is no consumer load in the circuit (e.g. incandescent lamp, electric motor, buzzer). The batteries then get very hot and discharge rapidly. A short-circuit also occurs if the cables are attached to the wrong places on the incandescent lamp socket (see below).

Contact points on the incandescent lamp holder

The incandescent lamp sockets have three contact points at which a cable can be attached: There is one lug on the right and one on the left at the same height (like "feet" on the holder), and also a small lug in the center of the socket mounted slightly higher. This makes contact with the shaft into which the incandescent lamp is screwed. In order for an incandescent lamp to light up a cable must always be connected to the small lug in the middle of the socket.
If a circuit is closed via the two "feet" on the right and left, this results in a short-circuit. The incandescent lamp does not light up but electric current flows. Therefore, make sure especially after completion of an experimentation unit that all cables are disconnected from the battery holder and the holders are suitable stored (see above).

General information on the topic of energy

Incandescent lamps and sockets

The incandescent lamps are screwed into the sockets. Depending on how well a child's fine motor skills are developed it may need the assistance of a teacher or another child to screw the incandescent lamp into the socket.

Battery holders

It makes sense to prepare a battery holder for each child in advance by inserting three batteries. The + and – signs in the battery holder help you insert the batteries the right way round (according to their polarity).

Buzzer

The buzzer is a load in the circuit which is polarized. That means that it only functions in one particular arrangement in the circuit. The colors of the cables indicate the positive and negative contacts. For the buzzer to sound, the red cable must be connected to the shorter contact of the battery holder, and the black cable to the longer contact. This still functions if additional cables are inserted between the red cable of the buzzer and the shorter contact of the battery holder or the black cable and the longer contact.
Note: The electric motor is not polarized.

Topic	Energy
Phenomenon	Current flows around a circuit
Experiment	Simple circuit
Material to be provided	3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 2 cables with alligator clips 1 incandescent lamp with a socket 1 magnifying glass
Additional Material	none
Preparation for experiment	Be absolutely sure to read the Energy safety information.

Researcher question

What do we need to make an incandescent lamp light up?

Description of experiment

Look for incandescent lamps with the children. Where do the children come across incandescent lamps in their everyday life, when do they need them, and what for? What exactly does an incandescent lamp look like? If each child uses a magnifying glass, they can see the filament in the incandescent lamp's globe.

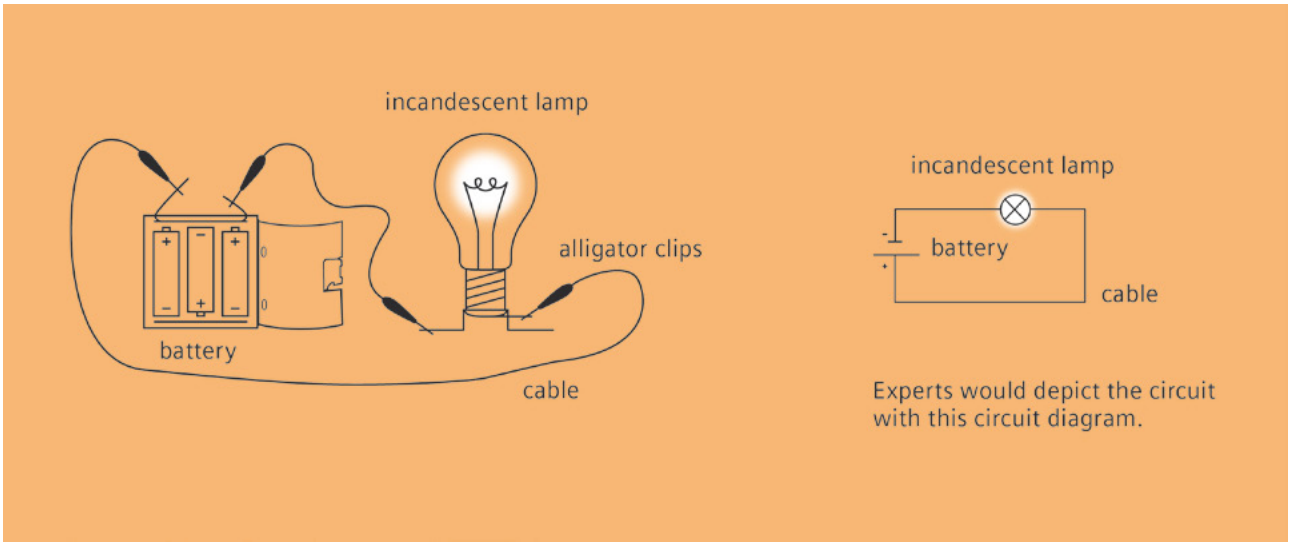
Together with the children, explore how they can make an incandescent lamp light up. For this purpose, get them to experiment with a prepared battery holder and an incandescent lamp with socket. Bear in mind that the lamp will only light up when the small central contact of the socket is connected to one of the two contacts in the battery holder. The second contact in the battery holder can be connected to the right or left contact of the lamp socket.

Explanation

The incandescent lamp lights up when it is connected to the battery holder in a particular way.
A closed conducting system is then established that begins and ends at the energy source. This circular system is known as a circuit. If the circuit is interrupted at any point, the lamp no longer lights up.
Make sure when experimenting that the children do not accidentally create short circuits, for example, if both contacts in the battery holder are connected to the left and right contact of the lamp socket. In this case, the batteries will discharge very quickly and heat up.

Further ideas

Show the children how to make the circuit bigger. Does the incandescent lamp still light up if they insert two more cables (with alligator clips) into the circuit?



Topic	Energy
Phenomenon	Current flows around a circuit
Experiment	Role-play to demonstrate electron flow
Material to be provided	none
Additional Material	none
Preparation for experiment	Children should have already had experience with a simple circuit.

Researcher question

How is energy transferred?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Discuss with the children how the energy from a battery passes around the circuit.

The children can model the flow of electrons in an entertaining way by standing in a circle and linking hands. This closes the electrical circuit.

In the circle, the first child represents the electron source, that is, the negative terminal of a battery, and starts off the squeeze of the hand. He or she uses his or her right hand to squeeze the next child's left hand. This child passes on the squeeze with his or her right hand. Further around the circle, a child represents a load, for example, an incandescent lamp. When this child’s hand is squeezed by the previous child, he or she stamps his or her feet. In this way, the child performs work in the same way that the incandescent lamp starts to light up in a circuit. However, at the same time this child passes on the squeeze of the hand to the next child because the circuit is still closed and the electrons continue to flow. The children continue to pass on the squeeze of the hand until it reaches the positive terminal (left hand) of the child playing the role of the battery.

Explanation

Electrical energy is transferred by the flow of electrons. Like charges repel, and unlike charges attract. For this reason, the negatively charged electrons migrate from the negative to the positive terminal of the energy source. However, this only functions if the circuit is closed.
In this circuit game, the child playing the battery sends out electrons from the negative terminal. These arrive back via squeezing the hand at the positive terminal of the battery.

A battery is used up when all electrons have migrated from the negative to the positive terminal of the energy source. This is when it needs to be discarded.

Topic	Energy
Phenomenon	Current flows around a circuit
Experiment	Conductors and non-conductors (insulators)
Material to be provided	1 strip of aluminum foil 1 balloon 3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 3 cables with alligator clips 1 drinking straw 1 incandescent lamp with a socket 1 nail or screw 1 paper clip 1 pair of scissors 1 spoon
Additional Material	Some strips of paper
Preparation for experiment	The children should have already had experience with a simple circuit.

Researcher question

What objects can electricity flow through?

Description of experiment

Give the children a battery holder with batteries, an incandescent lamp with socket, and three cables. Tell them to use these materials to make the incandescent lamp light up.

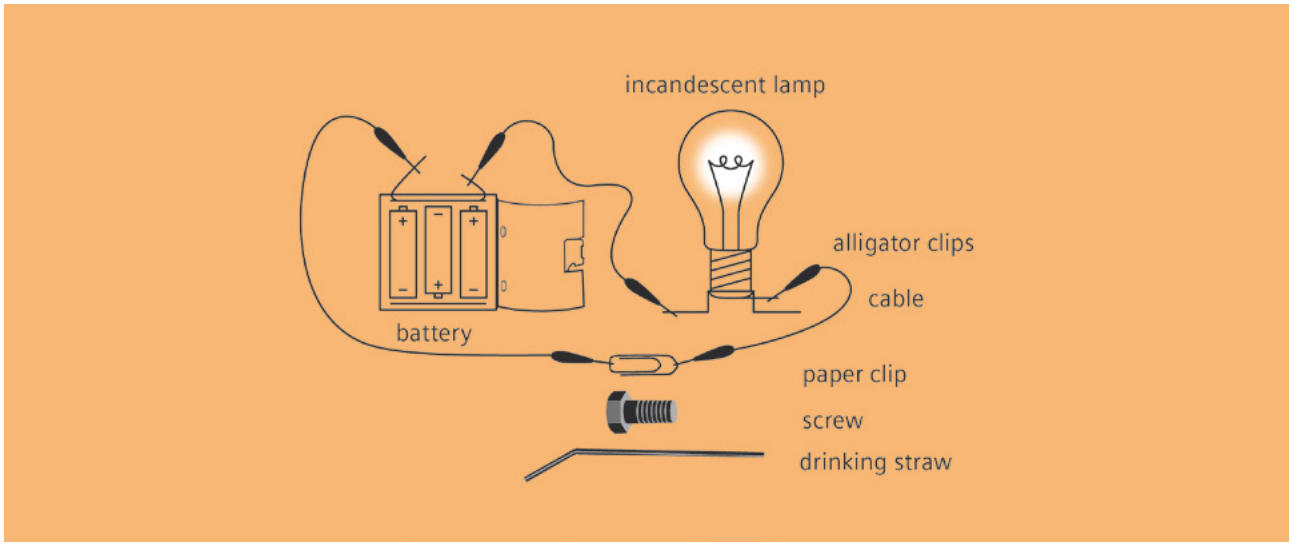
Ask the children if they have any ideas about how they can make the circuit bigger. As a suggestion, you can, for example, clip a nail or screw in between two cables. Does the incandescent lamp continue to light up? How does the incandescent lamp respond if the nail or screw is replaced with a strip of aluminum foil, a drinking straw, or a paper clip?

Together with the children, sort out the tested objects into those that light up the incandescent lamp and those that don’t.

Look for other test materials with the children, for example, scissors, a balloon, a spoon, or a piece of paper.

Explanation

The incandescent lamp lights up when electric current can flow in the circuit. Metals conduct electricity, so the incandescent lamp lights up when the children clip metallic objects like a paper clip, a nail or screw or aluminum foil between two cables. Since they conduct electricity, these objects are called “conductors”. Wood, plastic, and rubber do not conduct electricity. They are therefore called “non-conductors” or “insulators”.



Topic	Energy
Phenomenon	Current flows around a circuit
Experiment	Switches
Material to be provided	1 strip of aluminum foil (alternatively, additional paper clips can be used) 3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 3 cables with alligator clips 1 incandescent lamp with a socket 2 paper clips
Additional Material	1 strip of paper (approximately 10 cm long and 5 cm wide)
Preparation for experiment	The children should have already had experience with a simple electric circuit and different types of conductors and non-conductors. It is useful to prepare a switch to demonstrate before the lesson. For this you will need two paper clips clipped side by side on a strip of paper, and a strip of aluminum foil that is held in place under one of the paper clips (see diagram).

Researcher question

How does a switch work?

Description of experiment

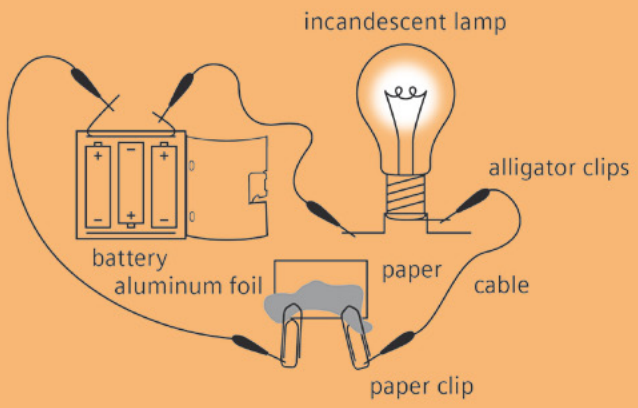
Discuss with the children how they turn lights on and off in their everyday life. The term “switch” is bound to come up. Suggest building a switch together.

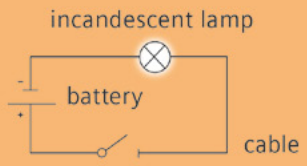
Give each of the children a battery holder with batteries, an incandescent lamp with socket, and three cables. Show the children the switch that you have prepared. Insert it into a circuit so that the incandescent lamp lights up. Discuss with the children what aspect of the switch has to be changed so that the incandescent lamp goes off. What do the children think will happen when one of them takes away the aluminum foil under the paper clip?

Enable each child to build a switch. Consider different ideas, for example, replacing the paper clips with aluminum foil or a screw.

Explanation

The circuit has to be closed in order to make the incandescent lamp light up. If the aluminum foil touches the paper clip, the circuit is closed and the incandescent lamp lights up. If the foil is folded away from the paper clip, the circuit is interrupted and the incandescent lamp no longer lights up. Switches function according to this principle.





Experts would depict the circuit with this circuit diagram.

Topic	Energy
Phenomenon	Current is consumed
Experiment	Batteries and their use
Material to be provided	2 batteries (1.5 V) 1 flashlight 1 magnifying glass
Additional Material	If possible, bring to class other flashlights and various battery-operated objects, for example, toys (including the batteries).

Researcher question

Where does the electric current in objects such as flashlights come from?

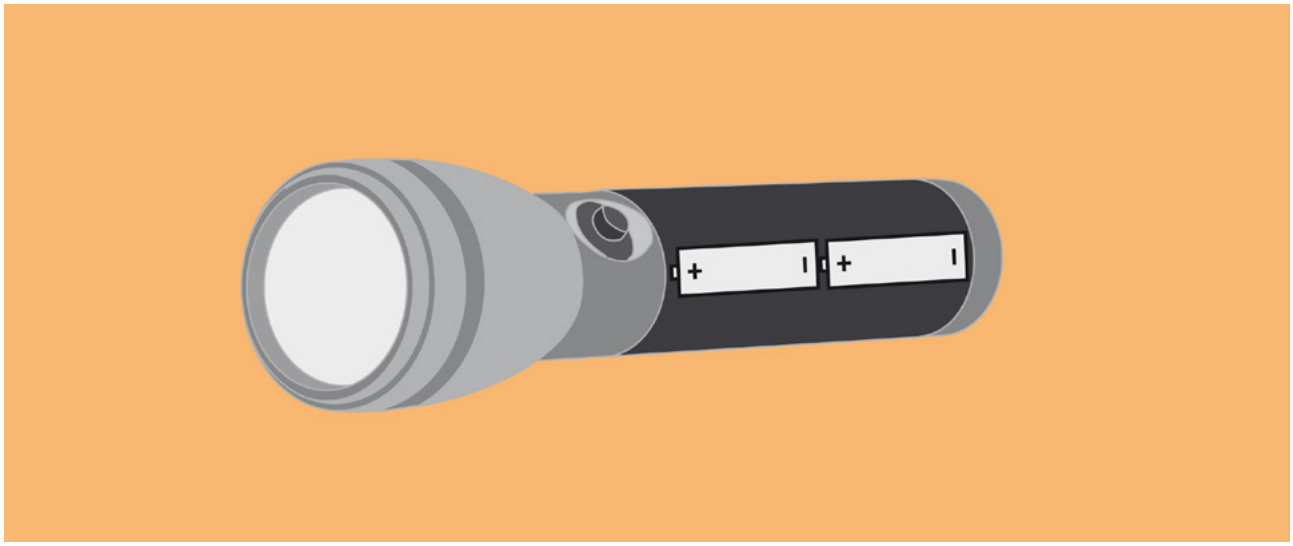
Description of experiment

Discuss with the children what they know about batteries from their everyday lives. Many toys need batteries in order to play tunes or to move. A flashlight also usually operates with batteries.

Investigate the construction of battery-operated objects with the children. Do they have any ideas where the battery (or batteries) is concealed? Or where the switch for switching a flashlight on and off is located? Examine with the children whether the position of the battery in the battery compartment makes a difference.

Explanation

Some toys and most flashlights need an electric current to operate. They obtain this current from batteries. Batteries have a positive and a negative terminal. When inserting a battery, it is necessary to observe the polarity: otherwise the appliance will not function. Fortunately, the terminals are marked (with + and – symbols) to help put the batteries in correctly.



Topic	Energy
Phenomenon	Current is consumed
Experiment	Batteries and their disposal
Material to be provided	1 battery (1.5 V) 1 magnifying glass
Additional Material	none
Preparation for experiment	Find out about the existence of collection or disposal sites for used batteries within your district.

Researcher question

What should we do with used batteries?

Description of experiment

If the children have already acquired experience with battery-operated devices (like toys and flashlights), they are probably already familiar with the concept that after a certain time the devices no longer function. Do the children have any ideas about why that is so?

This is usually because the battery is depleted. Discuss with the children what to do with the “old” battery. Give each child a battery and get them to look for symbols printed on them. A trash can with a line drawn through it can be seen on many batteries with the help of a magnifying glass.

Get the children to think about what the symbol means: In this case, it means that these batteries must not be thrown away along with the normal household garbage. Do the children have any suggestions as to why that would not be a good thing to do?

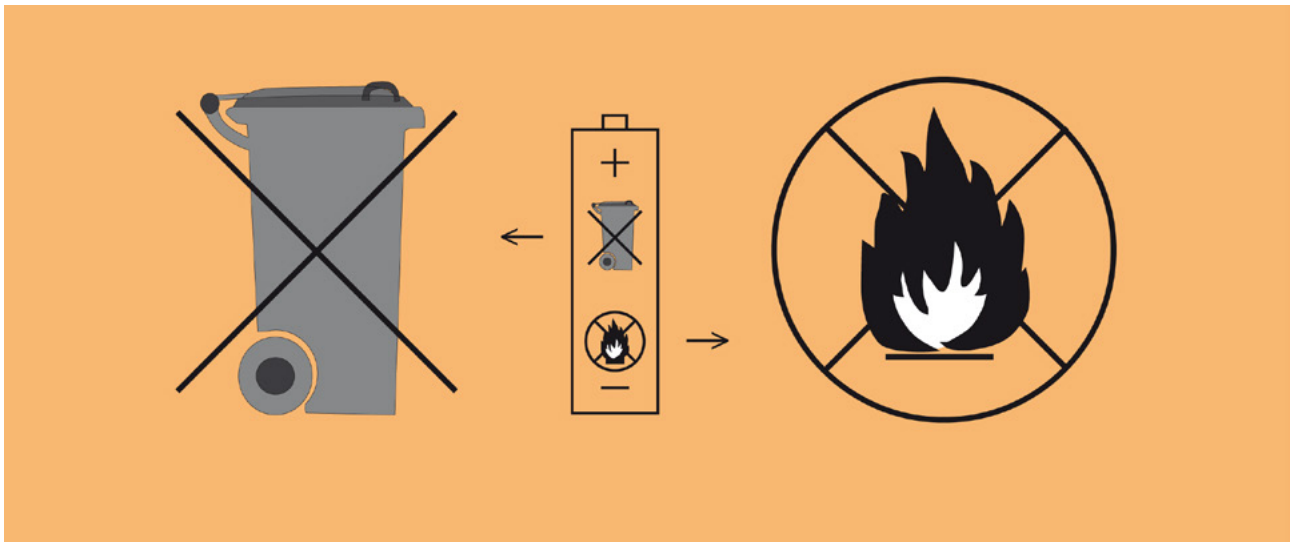
Explanation

Batteries contain toxic substances that can cause problems when they are disposed of with the household garbage: For example, these substances can find their way into the groundwater. For this reason batteries should be turned in at a collection site for used batteries. The batteries collected there are then recycled, in other words, parts of them are reused. Among other things, batteries contain metals that can be used for producing new batteries.

It can be very dangerous to throw batteries into a fire. They can break open or, worse yet, explode and pieces can fly around and injure people. Therefore most batteries are labeled with a symbol showing a fire that is crossed out.

Even if there is no collection site in your neighborhood, collect old batteries in a separate container so that you can dispose of them properly at a later time.

The situation is different with rechargeable batteries. By using additional energy, for example, from the plug socket, rechargeable batteries can be charged and used many times over. They do not need to be disposed of after a short time. We use rechargeable batteries for example in mobile phones.



Topic	Energy
Phenomenon	Current is consumed
Experiment	Various loads in a circuit
Material to be provided	3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 1 buzzer 4 cables with alligator clips 1 electric motor 1 incandescent lamp with socket
Additional Material	1 square of paper (approximately 10 x 10 cm)
Preparation for experiment	The children should have already had experience with a simple circuit. Remember that the buzzer is electrically poled (also see the safety information on the topic of energy).

Researcher question

What can we use a battery for? Can you only use it to make an incandescent lamp light up?

Description of experiment

Provide the children with a battery holder with batteries, an incandescent lamp with socket, and a variety of cables. Get the children to make the incandescent lamp light up.

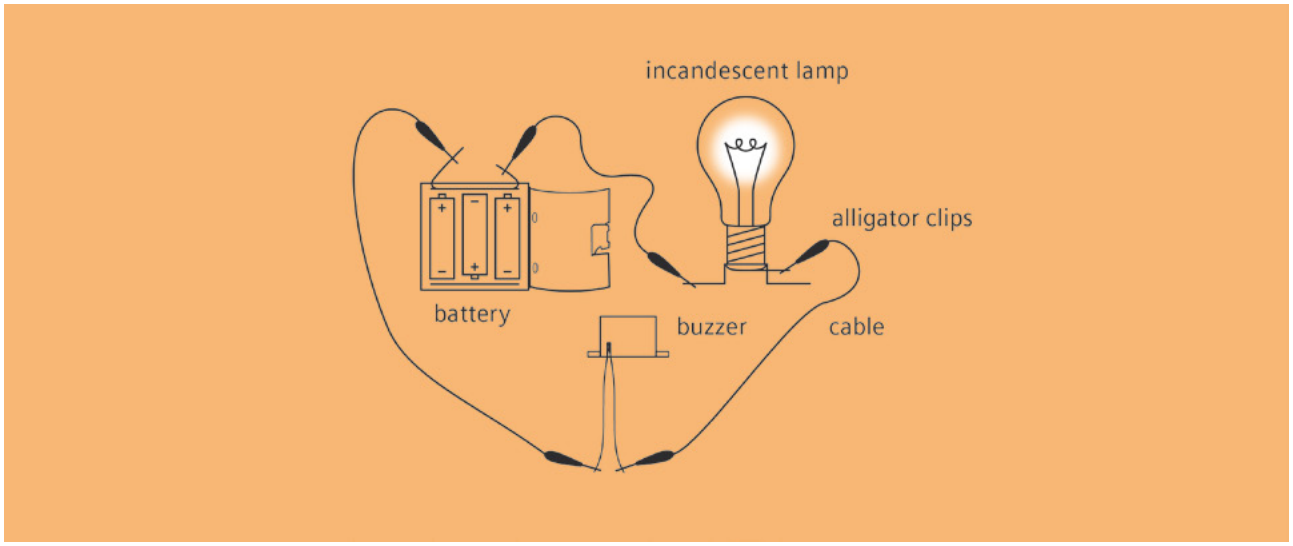
Present the electric motor and buzzer to the children. The buzzer can be used to build an electric bell. The electric motor can move something, for example, a piece of paper that is attached to the end of the electric motor. Do the children have any ideas about how they can insert the buzzer or electric motor into the circuit?

Elaborate on the ideas. For example, the circuit can be enlarged with additional cables and the buzzer or the electric motor can be built into the circuit in addition to or instead of the incandescent lamp.

The children should observe the circuits carefully and compare them. Do they recognize any differences?

Explanation

Electric current can not only make an incandescent lamp light up, it can also generate sounds (buzzer) or move something (electric motor). Current is also consumed in the process. If too many loads are connected to the battery, they no longer function properly because operating together they require too much power. If, for example, you connect an electric motor and an incandescent lamp in a circuit, the electric motor runs but the incandescent lamp can only light up very weakly: so weakly, in fact, that it may not be possible to see that it is lit at all.



Topic	Energy
Phenomenon	Current is consumed
Experiment	Series circuits
Material to be provided	3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 4 cables with alligator clips 2 – 3 incandescent lamps, each with a socket
Additional Material	none
Preparation for experiment	The children should have already had experience with a simple circuit.

Researcher question

What happens if we connect several incandescent lamps in a row to a battery?

Description of experiment

Get the children to build a large circuit together consisting of an incandescent lamp, a battery holder with three batteries, and several cables.

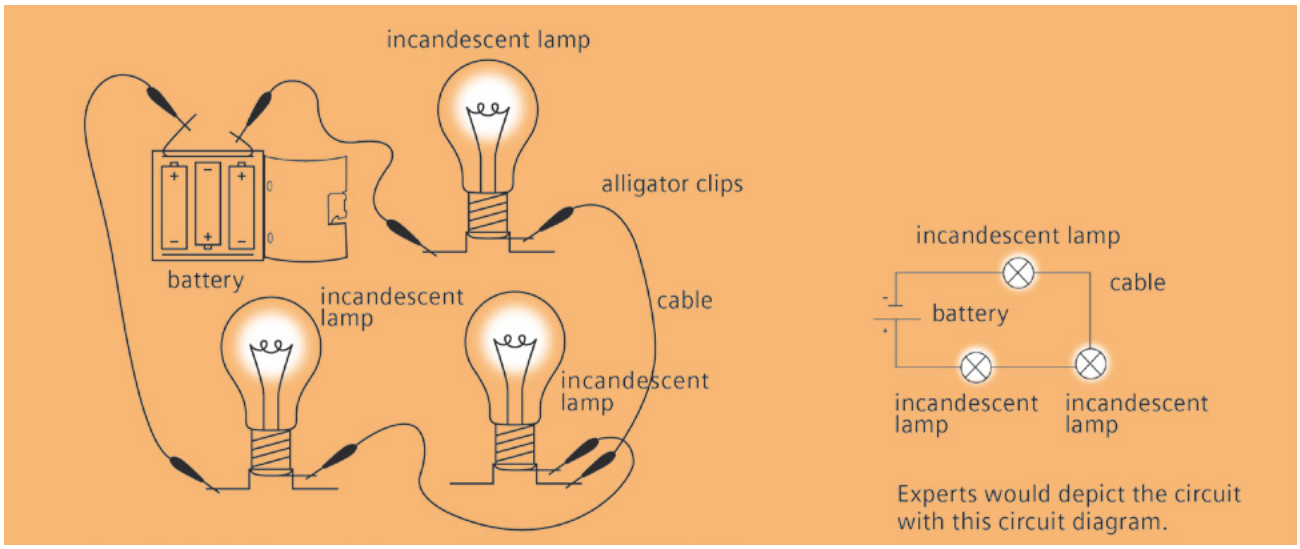
Now together with the children investigate whether additional incandescent lamps can be inserted in this circuit. For example, can an incandescent lamp with a socket be installed between the individual cables?

Observe with the children what happens when several incandescent lamps light up. Does the way the incandescent lamps light up change when an additional incandescent lamp is inserted in the circuit?

Do the children have an idea about what will happen when an incandescent lamp is unscrewed from the holder? Check the children’s ideas.

Explanation

If there are two incandescent lamps in a circuit, they light up less brightly than an incandescent lamp in a single-lamp circuit. If the incandescent lamps are connected in series, they have to share the current. This circuit is known as a series circuit. If you unscrew one incandescent lamp from its socket, none of the incandescent lamps will light up because the circuit is broken.



Topic	Energy
Phenomenon	Current is consumed
Experiment	Parallel circuits
Material to be provided	3 batteries (1.5 V) 1 battery holder (for 3 x 1.5 V batteries) 4 cables with alligator clips 2 incandescent lamps, each with a socket
Additional Material	none
Preparation for experiment	The children should have already had experience with a simple circuit.

Researcher question

What happens when we connect several incandescent lamps to a battery in parallel?

Description of experiment

Provide each child with a battery holder with three batteries, an incandescent lamp with socket, and two cables. Get the children to make the incandescent lamp light up.

Do the children have an idea as to how they can insert another incandescent lamp into the circuit without disconnecting the cable? As a hint, tell the children that they can use two additional cables.

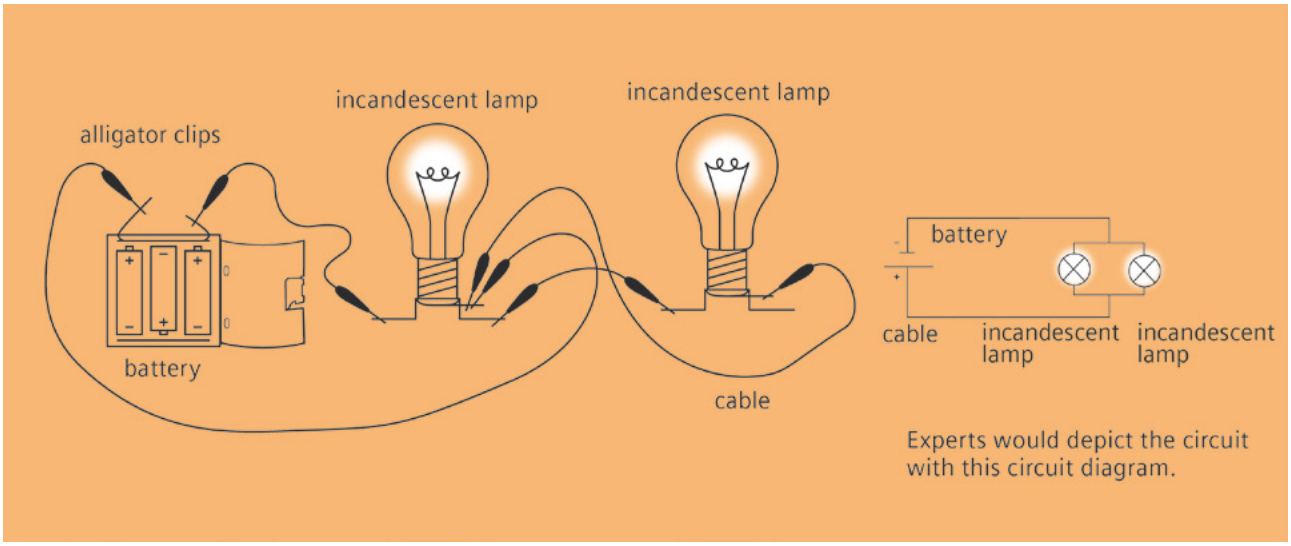
One possibility is to clip each of the two additional cables to one lug of the socket of the lit incandescent lamp. With your assistance, have the children clip another incandescent lamp between these two cables.

What happens if a child unscrews an incandescent lamp from the socket? Do the other incandescent lamps remain lit?

Explanation

Each incandescent lamp is connected to the battery in its own separate circuit. The incandescent lamps light up just as brightly as in the single-lamp series circuit. This circuit is also known as a parallel circuit. If you unscrew an incandescent lamp from the socket, the other incandescent lamp will remain lit.

More current is consumed in a parallel circuit than in a series circuit. If, for example, two incandescent lamps are connected in parallel, they consume more current than two incandescent lamps connected in series.



Topic	Energy
Phenomenon	Current is consumed
Experiment	A game teaching current consumption
Material to be provided	4 experiment containers 10 measuring cups
Additional Material	water (alternatively, sand or another material that can be poured) other large containers as necessary: for example, tubs, possibly additional measuring cups (depending on the number of children)
Preparation for experiment	This experiment should ideally be performed outdoors. The children should have already had experience with series and parallel circuits.

Researcher question

What are the different ways that the energy from a battery is used?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Divide the children into two equal teams. Each team is given two experiment containers. One of them is filled with water (or sand or similar material) – the same amount for each team. Give each child a measuring cup. The object now is to transfer the contents of one experiment container as quickly as possible into the other experiment container.

There are two possible ways of doing this:

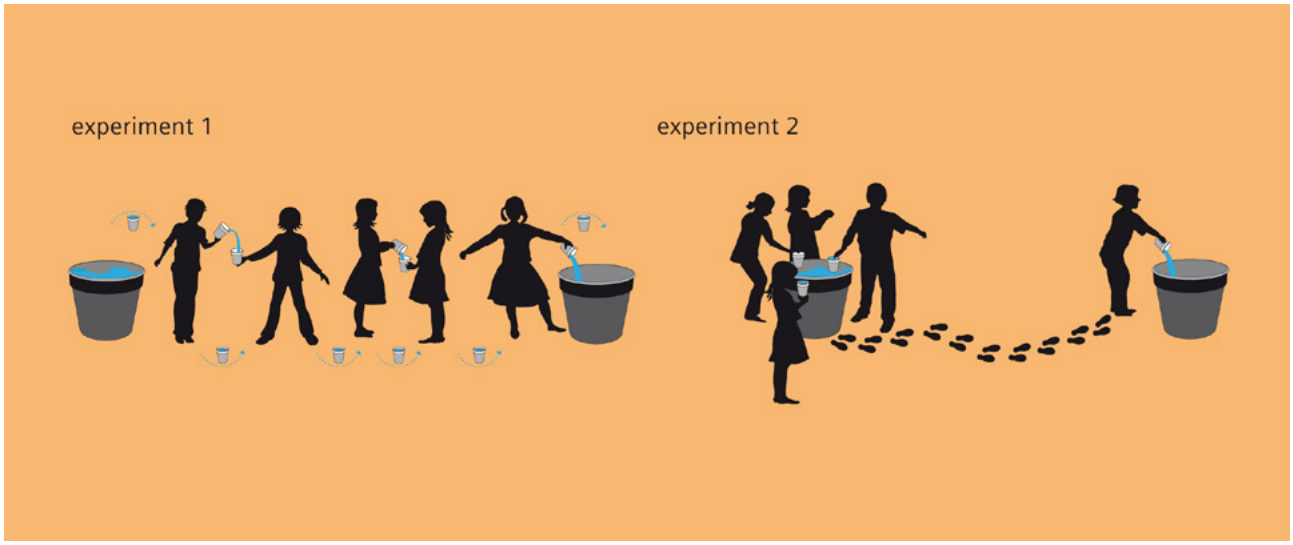
1. One of the children scoops water out of the experiment container with its measuring cup and pours it into the measuring cup of the next child, who then pours it into the next child's measuring cup, and so on. The last child pours the water into the second experiment container. This is continued until the first experiment container is empty.
2. All children stand around the container filled with water. They all scoop water out of the container simultaneously and pour it into the second container until the first container is empty.

Let the children experience these two methods!

Questions about "What is the fastest method of emptying the filled experiment container?", or "In which way is the water or sand passed on?" will motivate the children to try to discover the connection between this game and a series or parallel circuit on their own.

Explanation

If all the children scoop water out of the experiment container at the same time, it will be emptied more quickly. This is similar to the case of a parallel circuit, in which the two incandescent lamps are connected to a battery each in a separate circuit. In this case, the battery is exhausted more quickly compared with the series circuit. If one of the children drops out, the others can still continue scooping water – just as when one incandescent lamp is unscrewed, the others will remain lit.
If there is only one child scooping the water out of the experiment container, the same water passes through all the children's hands. That corresponds to a series circuit in which two incandescent lamps are inserted one after the other in the circuit. These two incandescent lamps share the current. If a child drops out, no more water can be passed on – just as when one incandescent lamp is unscrewed, none of the others can light up.



Topic	Energy
Phenomenon	Current is consumed
Experiment	Electrical appliances and their use
Material to be provided	12 crayons 1 glue stick 10 pairs of scissors
Additional Material	advertising brochures/catalogs with illustrations of electrical appliances and household objects as well as toys and electrical toys 10 sheets of paper additional glue sticks
Preparation for experiment	Obtain advertising brochures or catalogs in which electrical appliances, household objects, and toys (including electric toys) are illustrated.

Researcher question

What do we need electricity for in everyday life?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Ask the children what appliances or objects they know about that use electricity. Collect their suggestions on a large sheet of paper and hang it up in the room so that it is clearly visible. You can also display the children's ideas on the paper in the form of small pictures.

Find other appliances and objects together using the catalogs and brochures you have brought with you. The children can cut out objects that they recognize and create a collage, either alone or with others. Ideas can also be painted on the paper.

Ask whether these objects have always existed. Did the children's ancestors use these appliances? Discuss electricity-saving alternatives with the children, for example, candles instead of incandescent lamps or hand-held fans instead of electric fans.

Explanation

In many cases, it was not so long ago that households were first connected to the electrical grid. The children's great-grandparents did not necessarily have electric lights or appliances in their homes early in their lives. Making children aware of electricity-saving alternatives is important for learning to use energy responsibly.

Instructions Environment

Introduction to the topic of the environment

We must interact with our environment responsibly and sustainably and preserve our natural resources if we hope to protect the livelihood of future generations on the only planet we have and ensure the very survival of our species. But at the same time, “Environment” is a very broad field. Which issues do children care about most passionately, and what motivates them to explore exciting natural phenomena and processes?

The experimentation instructions of Experimento I 4+ teach children about the essential elements of water and air and sensitize them to certain consequences of pollution of the environment, water pollution, air pollution, and garbage. The experiments also give children the opportunity to explore and discover how they can live and act in harmony with the environment. The experiments sensitize the young boys and girls to conservation-minded behavior and strengthen their environmental awareness.

The experimentation instructions do not specify a particular order for the experiments, but you should always strive to build on what the children already know and make sure they understand the basics. The list of materials is designed for groups of three to four children.

Safety information on the topic of the environment

The children may conduct the experiments only under educator supervision.
The educator is to point out to the children that the provided materials may be used only according to the respective instructions.
Observe the following safety information as well as the applicable safety guidelines for your institution and discuss them with your children.

Safety-relevant materials and apparatus must be tested for proper functioning before being handed out to the children.

Working with ink

Generally, the ink in the kit is non-toxic. If the children are not specifically allergic to the ink, skin contact is usually not a problem.

However, ink is harmful if it is ingested. For this reason, store the ink bottles in a place that is inaccessible to children and point out to the children that they must not put ink in their mouths or drink it. You can substitute the ink with food coloring.

Collecting and separating waste products

When the children collect or separate different types of waste products, injuries may occur, such as cuts from paper or cans. Make sure that the children do not injure themselves. Be advised to carry a first-aid kit with you if you collect waste outside. If necessary, the children should wear work gloves, also to prevent infections (for example, tetanus). After the children collect the waste, they should wash their hands thoroughly.

Handling plastic wrap

Give the children pieces of plastic wrap that are only as big as needed for carrying out the experiment and not the complete roll of plastic wrap (risk of suffocation!).

Topic	Environment
Phenomenon	Water cycle
Experiment	Evaporation and vaporization
Material to be provided	1 experiment container 1 magnifying glass masking tape plastic wrap
Additional Material	water
Preparation for experiment	none

Researcher question

Where does the water in puddles disappear to?

Description of experiment

Ask the children if they have any ideas what happens to the water in puddles and why it eventually disappears again.

Together with the children fill the experiment container with water covering the bottom. Get the children to record the water level by marking it with a piece of masking tape directly on the experiment container. Place the experiment container in a protected and freely accessible place (for example, on a window sill). The next day the children will check the water level. What can be observed? What do the children observe over the course of several days?

Explanation

The water level in the experiment container drops every day. The water evaporates, i.e. individual water particles leave the water and rise into the air. The hotter the water, the more energy the water particles have and the faster they move. The faster the motion of the water particles, the more easily they can escape from the water surface. Hot water therefore evaporates more quickly. Wherever there is water, some of it evaporates, for example, in lakes, the ocean, rivers, or puddles.

Further ideas

Together with the children try to compare different types of containers with different water levels. The wider the container and warmer the location, the faster the water will evaporate.

What do you observe when plastic wrap is stretched over the containers? When water droplets form on the inside of the wrap (in other word it becomes wet), this is known as “condensation”.

Topic	Environment
Phenomenon	Water cycle
Experiment	Water cycle hand and finger game
Material to be provided	none
Additional Material	none
Preparation for experiment	The children should already have experience with the topic of evaporation.

Researcher question

What do the clouds in the sky consist of?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

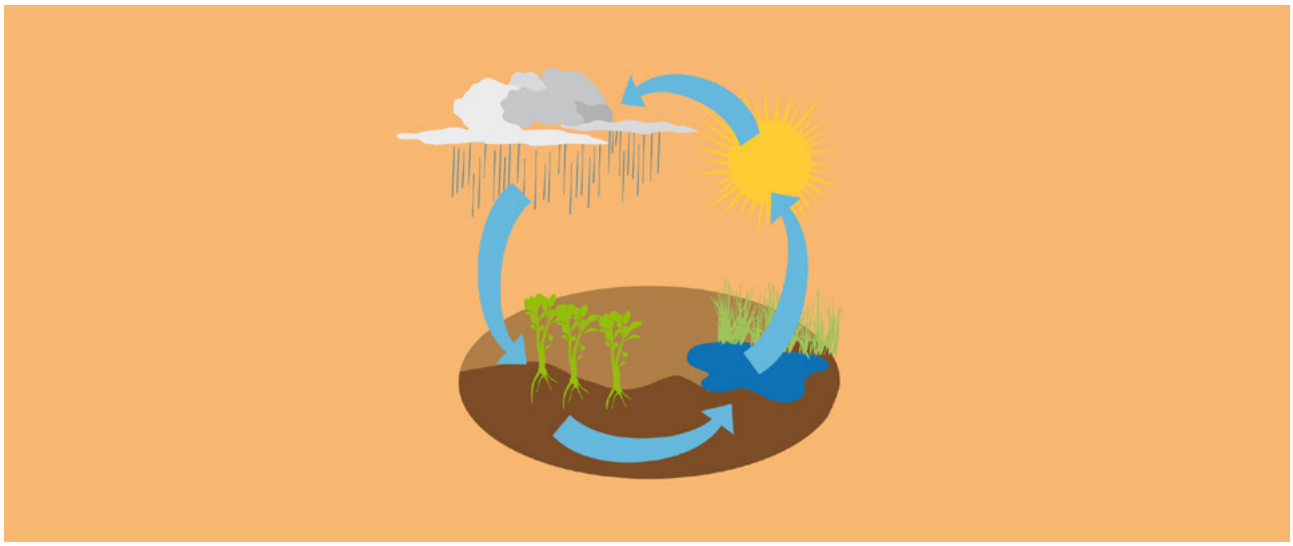
Ask the children what they think clouds consist of. The children will certainly know that there are rain clouds.

Suggest to the children that they play a game together in which they pretend to be rain. Ask the children to put their arms in the air and then bring them down towards the floor while waggling their fingers. Tell the children to drum on the floor with their fingers to simulate the sound made by rain. Have the children all join their hands together. Ask them what happens when a large number of water drops flow together. The children will doubtless know about (rain) puddles.

When the air is warmed by the sun, the water drops from the puddle rise back into the sky again in the form of water vapor and new clouds are formed. When the children have all raised their hands in the air again the clouds become heavier and heavier. Clench your fists to demonstrate. It doesn't take long before it starts to rain again – the children start lowering their hands down to the ground again while waggling their fingers.

Explanation

The children can make many observations of their own based on different weather situations. Many of these observations provide information about natural phenomena. The water cycle is an important element that can be well illustrated with the game described to provide a first fundamental understanding of weather. The rain falls on the ground and collects, for example, in puddles. The sun heats the water in the puddle and causes it to evaporate. The water vapor rises into the sky in the form of moist air. In the higher air strata the air cools down again, the "invisible water" from the puddles condenses into water droplets from which clouds are formed. Small water droplets combine to form larger drops. If these become too heavy the water falls to earth again as rain.



Topic	Environment
Phenomenon	Erosion
Experiment	Natural forces
Material to be provided	1 laundry sprinkler
Additional Material	1 tray or large bowl earth, gravel, sand, stones water
Preparation for experiment	none

Researcher question

What happens to the landscape in wind and rain?

Description of experiment

Get the children to build a small landscape with mountains made of stones, sand and earth on the tray or in the bowl or on an open area outside. Ask the children to be the wind, the water or observers. The children in the wind group have the task of blowing or fanning the small landscape, while the water group can represent rain of various degree of heaviness with the laundry sprinkler or other containers.

Ask the children about what they have observed. What happened to the stones and the sand? What has changed? Ask the children to suggest what they think would happen to plants and trees.

Explanation

Erosion means the linear removal of the earth's surface over an extensive area. Wind blows and rain pours over the earth. Large stones (rocks) remain in place, but sand and earth are blown away by the wind and washed away by heavy rain. If the soil is planted, the roots of the plants hold the soil firm and it is not washed away so easily.

Further ideas

If you have the chance to create this landscape outdoors, you can observe it together with the children over a long period and discuss what you see happening.

Topic	Environment
Phenomenon	Water pollution
Experiment	Water hodgepodge
Material to be provided	1 magnifying glass 1 measuring cup 1 spoon, small
Additional Material	cooking oil earth, sand, small stones and similar materials water
Preparation for experiment	none

Researcher question

How does water become polluted?

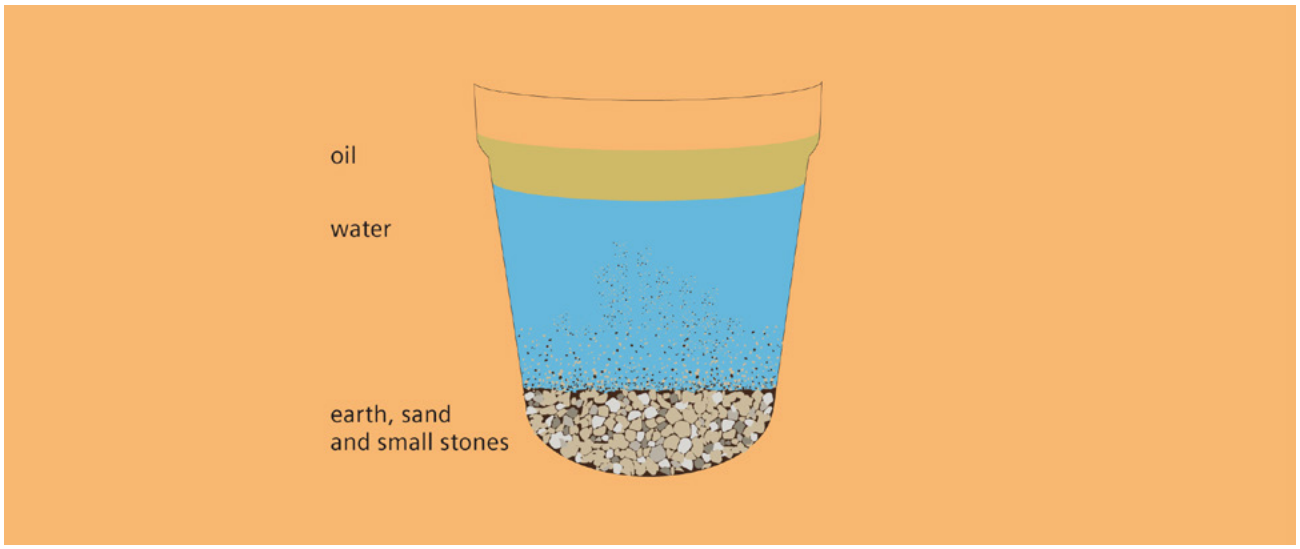
Description of experiment

Encourage the children to think about how water gets polluted.

Fill the measuring cup to about half with water. Tell the children to fill the measuring cup of water with various materials to simulate water pollution. Tell them to watch carefully how the water and the added materials behave. What floats on the top? What sinks to the bottom? Perhaps one of the children will have the idea of stirring the mixture – let the children try this and discuss their observations together. How does the mixture behave when oil is added?

Explanation

Liquids that are poured into water frequently mix with it and then cannot be easily separated. Heavy substances, for example earth or stones, settle to the bottom of the vessel after a while, whereas oil floats on the surface of the water because it is lighter than water. Although some of the oil can be poured off from the top (decanted), it is very difficult to achieve complete separation.



Topic	Environment
Phenomenon	Water pollution
Experiment	Purifying water by means of a filter
Material to be provided	1 piece of filter paper 1 magnifying glass 1 measuring cup 1 pipette
Additional Material	cooking oil earth, sand, small stones and similar materials water
Preparation for experiment	none

Researcher question

How can we clean polluted water?

Preparation for experiment

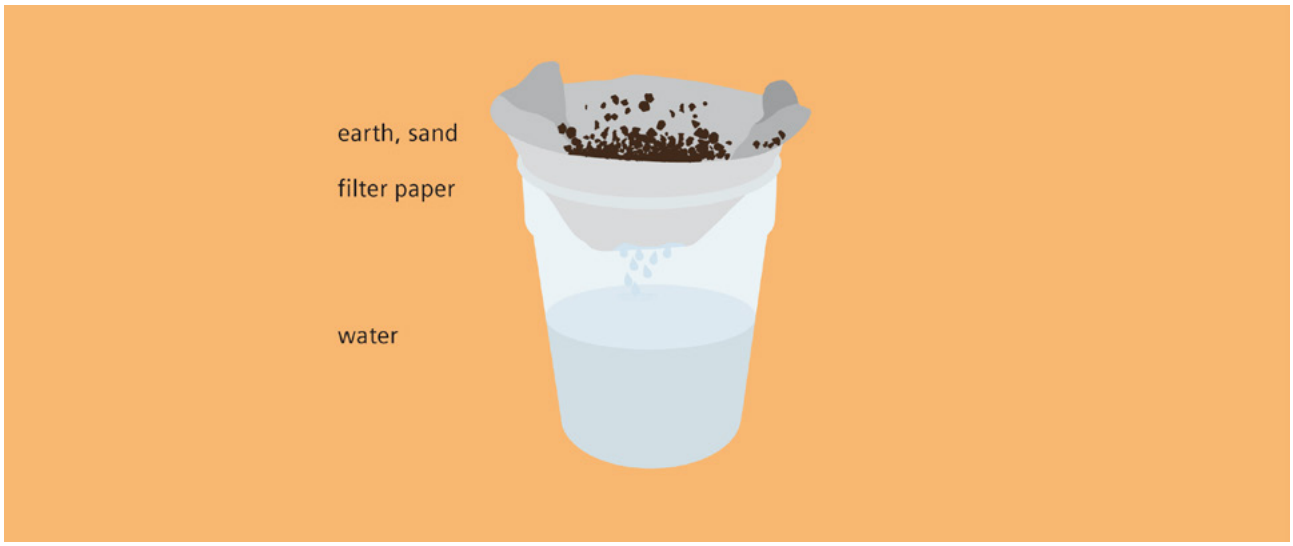
Together with the children think about how water becomes polluted. Do the children have any ideas about how water can be made clean again? You may have already spoken to the children about water pollution and carried out the water hodgepodge experiment.

Give each group of children a measuring cup and a piece of filter paper. Ask the children to place the filter paper over the top of the measuring cup like a lid. Now suggest to the children that they pour a little water into their measuring cup through the filter paper, for example with the aid of a pipette. It is fine for the moist filter paper to sag somewhat in the center and form a small indentation. What do the children observe? How does this function with other materials such as small stones, earth, oil, etc.? Is it easy to pollute the water? What function does the filter appear to have?

Human beings, animals, and plants need water to live. Discuss with the children what they can do to help prevent water pollution.

Explanation

Water filters in various shapes and sizes are used for purifying water. The objective of using them is to remove particles causing turbidity or microorganisms as well as to remove substances dissolved in the water or to reduce their concentration. Some filters work purely physically like a sieve, such as the filter used in this experiment. However, there are also filters with chemical and physical actions that can remove substances dissolved in water.



Topic	Environment
Phenomenon	Water pollution
Experiment	Making dirt in water visible
Material to be provided	1 bottle of ink 1 magnifying glass 1 measuring cup 1 pipette
Additional Material	2 sugar cubes water
Preparation for experiment	none

Researcher question

Can we always see water pollution?

Description of experiment

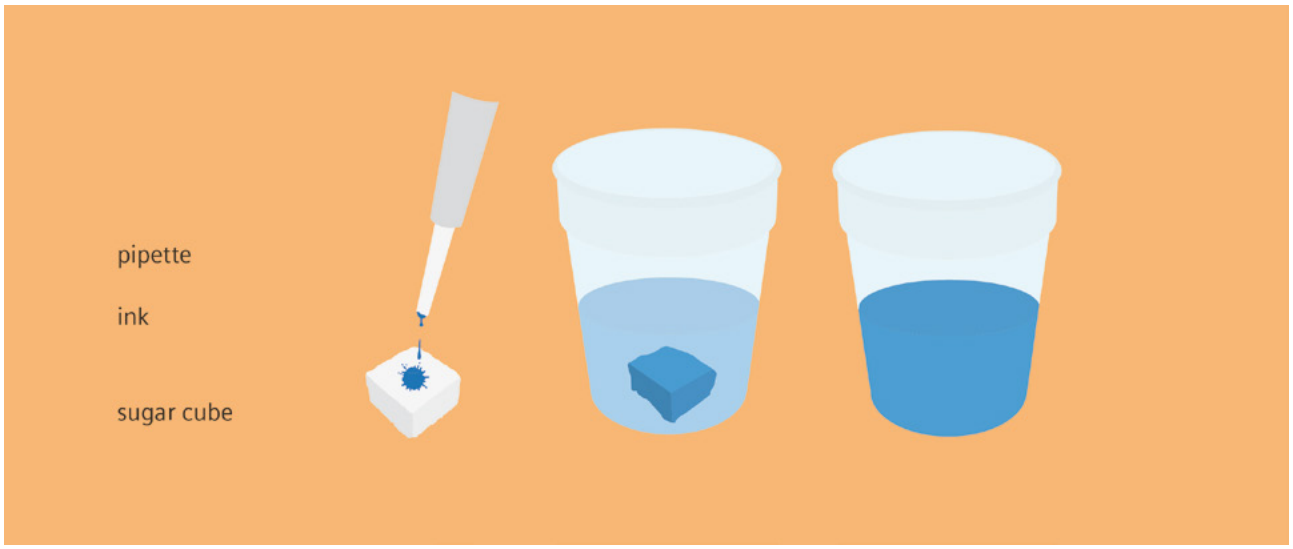
Think about the causes of water pollution with the children and whether there is also dirt which we can't see at first glance?

Give each group of children a measuring cup filled up to about half with water. Tell the children to put a sugar cube in their water cup. What happens to the sugar cube and what can be observed? What suggestions do the children have? Has the sugar really simply disappeared?

Now ask the children to color a second sugar cube with a few drops of ink and repeat the experiment. What can they observe now? Has the sugar really simply disappeared? What happens to the color of the water?

Explanation

We cannot see some of the substances that pollute our water with the naked eye. The experiment with the sugar cube illustrates how different substances mix with water. The coloring effect of the blue ink shows the extent to which these substances can propagate. In particular, liquid waste products from industrial plants or domestic waste water contain chemicals that pollute our water, but are not always visible. This makes it all the more important to purify and treat drinking water carefully.



Topic	Environment
Phenomenon	Water pollution
Experiment	When plants drink
Material to be provided	1 piece of filter paper 1 bottle of ink 1 measuring cup
Additional Material	water
Preparation for experiment	none

Researcher question

What does contaminated water do to plants?

Description of experiment

Ask the children if they know what plants feed on. The children are bound to bring up the fact that plants need water to live and grow. Ask the children whether they have any ideas about whether plants also drink dirt that is mixed up in the water. Is polluted water good for plants? Also ask the children how they feel about the water they drink.

Fill the measuring cup with water and have the children help you dye the water with the ink. Ask them to roll up the filter paper and place it in the water to act as a flower stem. What can you observe? What happens to the color of the filter paper?

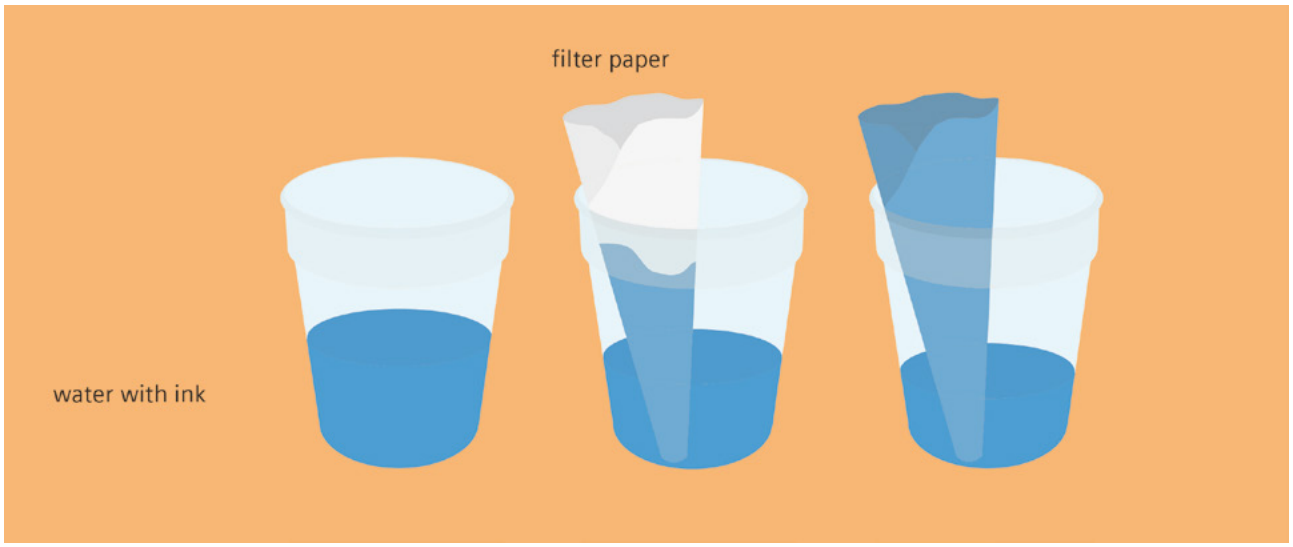
Explanation

You can see how the paper absorbs the dyed water and gradually changes color.

Plants absorb water from the earth through their roots. From the roots the water travels through the stem to the leaves and flowers. This path can be made visible with the dyed water.
Help the children to understand that polluted water does not do the plants any good and can even harm them.

Further ideas

Alternatively, you can also take flowers and plants with clearly visible white petals. Cut the stems off short and get the children to help you place the flowers or plants in colored water. Watch together to see what happens to the blossoms. The blossoms take up the color faster if the flowers do not come directly out of a vase and are really thirsty.



Topic	Environment
Phenomenon	Existence of air
Experiment	Making air visible
Material to be provided	1 experiment container 1 – 2 measuring cups
Additional Material	water
Preparation for experiment	Fill the experiment containers about half full with water.

Researcher question

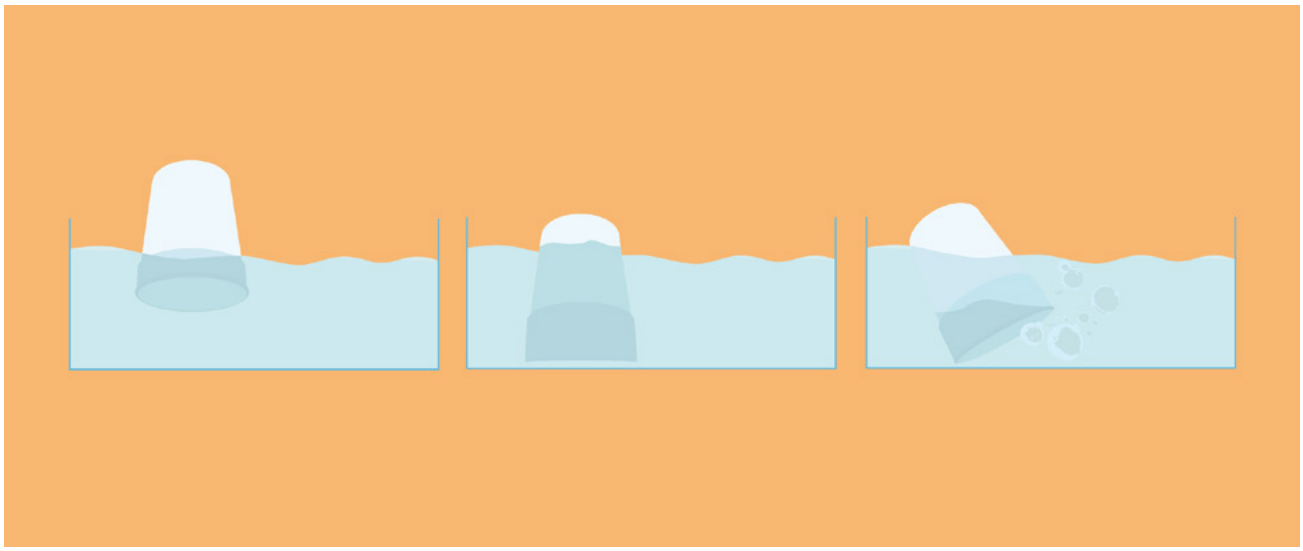
Can we see air?

Description of experiment

Provide each group of children with one or two measuring cups so that they can see for themselves how to make air visible. Ask the children to suggest ideas as to what happens if they immerse their measuring cups upside down vertically into the experiment container filled with water.
When the measuring cup reaches the bottom of the experiment container, ask the children to see what happens if the measuring cup is tipped slightly to one side. What do the children observe? The children can place their hands on the surface of the water so that they can feel the air escaping upwards. Encourage the children to think about this and help them describe what they have discovered.

Explanation

Air does not consist of nothing! Even apparently empty vessels contain air. To see air and understand its existence, you can make air visible and audible. In the experiment described here some of the air is replaced by water when the measuring cup is tipped slightly to one side. Tipping the measuring cup allows water to enter it, thereby displacing the air from the measuring cup. Since the air is lighter than the water, it rises in the form of air bubbles to the water surface where it recombines with the ambient air.



Topic	Environment
Phenomenon	Existence of air
Experiment	Feeling air
Material to be provided	1 balloon 1 plastic bottle
Additional Material	none
Preparation for experiment	none

Researcher question

Are empty bottles really empty?

Description of experiment

Ask the children what is in the empty, closed plastic bottle. Collect the answers and ideas that they give and suggest to the children that you examine these answers together.

Give each group of children a well-sealed plastic bottle. Tell the children to try to squash their plastic bottle by pressing them firmly with both hands. What happens? Can they squash the plastic bottles?

Ask the children to suggest ideas as to how it might be possible to squash the plastic bottles. Have them open the plastic bottle cap and then repeat the experiment. Why does it work this time? Do the children have any ideas about this? Do the children feel anything at the mouth of the plastic bottle?

Explanation

We cannot see, smell, or taste the air all around us but we can feel it. An apparently empty plastic bottle also contains air. If the plastic bottle is closed with a cap, the air in the plastic bottle cannot escape nor can the ambient air enter the plastic bottle. If you try to squash a plastic bottle, you won’t have a lot of success as long as the plastic bottle remains closed. The air stays put in the plastic bottle and cannot be displaced. If we open the cap we can “squeeze” the air out of the plastic bottle by pressing it with our hands, and then we can squash the plastic bottle. We can feel the air as it escapes from the plastic bottle.

Further ideas

Blow up some balloons together with the children. Ask them what is in the filled balloon and ask them to think of ways in which their suggestions can be tested. Try out the various ideas together with the children. Perhaps one of them knows that you can make a squeaky noise with a balloon if you stretch the mouthpiece while the air is escaping. Can air also be made audible in this way? What ideas do the children have about this?

Topic	Environment
Phenomenon	Air pollution
Experiment	Making dirt in the air visible
Material to be provided	cream 1 spoon, small
Additional Material	none
Preparation for experiment	none

Researcher question

Can air become dirty?

Description of experiment

Ask the children if they have any suggestions about what can make the air dirty.

Ask the children to coat the spoon with the white cream and place it outdoors in an area protected from the rain. Inspect the coated spoon with the children from time to time and see if there are any changes. When they see dirt in the cream, discuss with the children their ideas as to what the deposits consist of. Get the children to think about where the dirt on the spoon could come from. Perhaps one or more of the children will hit upon the idea that dust from the street, car exhaust fumes, or open fires can cause detectable dark clouds of dirt.

Explanation

Air pollution is also a form of environmental pollution. Pollution occurs as a result of a change in the natural composition of the air, especially due to particles of smoke, soot, dust, and vapors. Natural processes such as biological decomposition (for example the rotting of plant material) can also lead to air pollution.

Topic	Environment
Phenomenon	Waste separation
Experiment	Feeding animals
Material to be provided	Set of pictures: animals Set of pictures: foods Set of pictures: litter and waste products
Additional Material	none
Preparation for experiment	none

Researcher question

What do animals eat? What is unhealthy for them?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Put the animal pictures on a table or on the floor so that all children have a good view of the picture set. Ask the children which animals they already know and which ones they don't know yet. Tell the children primarily about the habitat of the animals and their preferred food. Now show the children the other sets of pictures and encourage them to think about which animal eats what. What is left over?

Get the children to think about what the remaining materials are. Where do these things come from?

Explanation

Animals are herbivores or carnivores. However, sometimes they also eat other things they find in their habitat. If we carelessly leave glass, plastic, metal or toxic substances lying around out in nature, it can permanently harm the health of animals. Pointed and sharp-edged objects can injure the mouths, throats or internal organs of animals. Indigestible things can accumulate in the stomach or intestines and lead to long-term damage to the animals health or even fatally poison them.

Further ideas

Go for a walk with the children in your local environment and identify the waste you find along the way. Explain to them why it is important to keep the environment clean.

Topic	Environment
Phenomenon	Waste disposal
Experiment	“A walk to look for garbage”
Material to be provided	plastic wrap
Additional Material	fruit or vegetable leftovers
Preparation for experiment	none

Researcher question

What sorts of things do we find in our local environment? What should not be there?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Ask the children if they know where garbage comes from and what happens to the different types of waste.

Go for a walk with the children in the local area and look for garbage that has been thrown on the ground heedlessly. Collect any plastic and glass bottles as well as paper that you come across.

Ask the children where the garbage could have come from, what materials it consisted of originally or what it was used for. Think about where the garbage really belongs, i.e. it should be collected and why it is not good for the environment if people simply throw their garbage on the ground.

Set up the experiment. Get the children to place a piece of plastic wrap and a piece of leftover fruit or vegetable (weighted down with a stone so that it cannot blow away) in a protected location in the area that is easily accessible to the children. Together with the children observe what happens to the two materials over a long period. The plastic wrap remains, and the fruit or vegetable leftovers change their appearance and structure or are eaten by an animal.

Explanation

Not everything that is thoughtlessly thrown away in nature rots or is eaten by animals. Everything that is not biologically degradable usually remains around for a very long time, altering nature and even harming it in certain cases.

Topic	Environment
Phenomenon	Waste disposal
Experiment	Waste separation and avoidance
Material to be provided	none
Additional Material	large sacks or cartons suitable for collecting garbage
Preparation for experiment	none

Researcher question

How much waste is produced in a week?

Description of experiment

This experiment should not be conducted in small groups, but together with the entire group of children.

Ask the children what kinds of garbage they know about and where waste is produced. How much waste material do the children think they produce together in a week?

Suggest to the children that they collect all garbage accumulating from now on in the sacks or cartons so that at the end of the week they can see what and how much they have accumulated together. After collecting for a whole week look with the children and see what has been collected. What types of garbage are there? Together with the children separate the plastic, paper, and glass again. What did the children not expect to see as garbage when they originally thought about it? What is the most common type of waste?

Explanation

Garbage is produced in many everyday situations and needs lots of space. Many waste products are not degradable by natural means, but are at least recyclable, i.e. they can be processed for reuse. Garbage which is simply dumped in the countryside pollutes our environment and hence the Earth on which we live. Thoughtlessly dumped waste also spoils the appearance and the beauty of a landscape. A first important step towards environmental protection is therefore a responsible approach to garbage. Separation of garbage and avoidance of waste are really easy and quick to do.

Waste that cannot be recycled must be disposed of separately. This can either be incinerated or stored very carefully. In this context also address the topic of batteries, which must be collected separately, since they belong to this group of waste products.

Further ideas

Get the children to think about how they can actively avoid creating garbage and consider possible ways in which they can put this into practice.

Instructions Health

Introduction to the topic of health

Health is our most precious possession. But for children, health is an abstract concept and typically less meaningful in their own environment. This makes it all the more important to find a fun way to sensitize children to health issues so they can develop a sense of this vital topic early on.

The experimentation instructions of Experimento I 4+ encourage children to take a close look at the human body. Exemplary, the children familiarize themselves with certain organs and their vital functions, learn about the structure of the human skeleton, and study the shapes and functions of the various bones. The children also explore the human senses and discover how these can support us in our individual perception of the world around us. What do we sense? How do we sense it?

The children can perform the experiments in any order, depending on their interests. The list of materials is designed for groups of three to four children.

Safety information on the topic of health

The children may conduct the experiments only under educator supervision.
The educator should point out to the children that the provided materials may be used only according to the respective instructions.
Observe the following safety information as well as the applicable safety guidelines for your institution and discuss them with your children.

Safety-relevant materials and apparatus must be tested for proper functioning before being handed out to the children.

Experiments with foods

Discuss the difference between foods for consumption and foods as “experimentation material”. Explain the rule against eating and drinking during experiments for health reasons. This rule is intended to keep the children from consuming anything that could trigger an allergy or intolerance. Point out to the children that they may taste something only when it is expressly permitted. In such cases, potential intolerances and/or allergies should be clarified beforehand. Before starting, you need to wash all fruits and vegetables that will be used over the course of the experiment.

Materials for smelling

In the experiment “Distinguishing and recognizing odors” avoid using substances with a pungent smell such as vinegar or dangerous substances such as gasoline. In the smelling game the children should not swallow any of the collected materials.

Working with objects with sharp edges or points

Scissors and other sharp or pointy objects entail a certain risk of injury. Therefore, it is important for children to master the safe handling of these tools and objects. Demonstrate the correct use of the materials or prepare individual steps of the experiment in advance for the children. Do not use objects with sharp edges or points such as scissors, pins, toothpicks, etc. for the sensory memory game.
Discuss the safe handling of pins with the children. Make sure especially that in the scab forming experiment the cork tiles are on a firm base when sticking in the pins and not, for instance, resting on the children’s legs.
The color wheel top must have a sharp object such as a pin stuck through the centre. Help the children to pierce the color wheel so that they do not injure themselves. The wooden dowel forming the wheel axis is then placed in the hole.

Using the stethoscope

Discuss with the children the fact that the human ear is a very sensitive organ. To prevent hearing impairment, they should conduct the experiments calmly and carefully. The stethoscope significantly amplifies heart sounds and breathing noises. However, it also amplifies other sounds, for example if the children bang on the earpiece. This can be very loud and unpleasant in the ears. Make sure that the children use the stethoscope with appropriate care.

Topic	Health
Phenomenon	Inside the body
Experiment	Our bones
Available material	2 – 3 crayons or pieces of sidewalk chalk 1 glue stick illustration of the human skeleton masking tape
Additional material	several sheets of newspaper, scrap paper, or wrapping paper
Preparation for experiment	Using the masking tape or glue stick, join together several sheets of newspaper to create a paper surface on which a child can lie comfortably with arms and legs stretched out and slightly apart. Stabilize the newspaper on the floor using masking tape or stones. Any clean, firm, level surface (wood floor, stone floor) can also be used instead of newspaper.

Research question

What are the components that make up our body? What bones are inside our body?

Description

Several children work together in teams. One of the children lies on the newspaper with his or her arms and legs slightly apart, and the other children draw around his or her outline with the crayons as precisely as possible. Alternatively, the outline of the body can also be drawn with sidewalk chalk on a firm, level surface.

Together with the children, think about what body parts make up the human body and what they are called. The children can point to themselves and to the outlines they have drawn to show where these parts of the body can be found.

Look at the illustration of the human skeleton with the children. Encourage the children to feel the bones shown there in their own bodies.

Explanation

Bones, muscles, and sinews support and shape our bodies. Because the individual bones have different functions, they differ from each other in shape and size. The longest, strongest bones in the body are in the legs.

Topic	Health
Phenomenon	Inside the body
Experiment	Our organs
Available material	clothespins 2 – 3 crayons or pieces of sidewalk chalk 1 glue stick illustration of the organs in the body masking tape 1 set of pictures: organs 1 stethoscope
Additional material	several sheets of newspaper, scrap paper, or wrapping paper
Preparation for experiment	Using the masking tape or glue stick, join together several sheets of newspaper to create a paper surface on which a child can lie comfortably with arms and legs stretched out and slightly apart. Stabilize the newspaper on the floor using masking tape or stones. Any clean, firm, level surface (wood floor, stone floor) can also be used instead of newspaper.

Research question

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Together with the children, think about what body parts make up the human body and what they are called. Which parts are soft? Which parts can we see, and which are hidden? The children can point to themselves and to the outlines they have drawn to show where these parts of the body are found.

Look at the illustration of the organs in the body with the children. Working together, try to insert the individual organ pictures from the set of organ pictures onto the body outlines they have drawn, or to attach them to the correct parts of their own bodies by pinning them to their clothing with the clothespins.

Explanation

In the torso, lots of organs lie over, under, and next to each other in a confined space. Every organ performs certain tasks in our body. The brain in our head is the body's control center. The heart pumps blood through the blood vessels into every part of our body. In the lungs, the oxygen needed by all the cells in the body is absorbed. The stomach is a sort of mixer in which food is prepared for digestion. The liver, gallbladder, and pancreas help with digestion. The spleen filters cells that are no longer functioning out of the blood. Most nutrients are absorbed from food in the small intestine. This also occurs in the large intestine, where waste products are collected for excretion. The main task of the urinary organs, especially the kidneys, is to clean the blood and to dispose of the waste matter in the urine.

Further ideas

Suggest to the children that they could listen to each other's stomachs and chests with one ear or the stethoscope to hear the stomach noises and the heartbeat. Blood vessels through which the blood flows can be easily seen on the inside of the wrist, for example – point this out to the children.

Topic	Health
Phenomenon	The limbs
Experiment	Our hand
Available material	2 – 3 crayons illustration of the hand bones masking tape 1 – 2 pairs of scissors
Additional material	3 – 4 sheets of paper (A4)
Preparation for experiment	If necessary, stabilize the paper on which the children are drawing using masking tape.

Research question

Is our hand a tool?

Description

Suggest to the children that they draw around their hand on a sheet of paper and then cut out the outline. Find out together who has larger hands and who has smaller ones.

Continue researching with the children: How many fingers does a hand have, what are they called, how long are they? How often and at which points can each finger and the whole hand be bent? Fingernails and “bend points” (joints) can be marked on the paper hands, as can the bones that are felt in the hand. Look at the illustration of the bones in the hand together.

Working together, find examples of what we use our hands for (for example, waving, knocking, gripping), and when we use them as a kind of tool. Is it possible to get a good grip without the thumb?

Explanation

Human hands consist of five fingers (thumb, index finger, middle finger, ring finger, and little finger). The middle finger is often the longest finger, and the thumb is thicker than all the other fingers. The left and right hands mirror each other. The thumb has one joint fewer than the other fingers. All the fingers are flexibly connected with the bones in the back of the hand, and these are connected in turn with the bones in the wrist. There is another movable connection between the radius (arm bone) and the wrist bones. The movement of the hand is controlled by muscles, sinews, and nerves. The palm of the hand and the tips of the fingers are parts of the body that are especially sensitive to touch; they contain a very large number of sensory cells.

Topic	Health
Phenomenon	Senses (smell)
Experiment	Distinguishing and recognizing odors
Available material	cotton 10 film canisters
Additional material	strong and characteristically-smelling foods or materials (for example, onions, coffee, cinnamon, lemon, herbs, fresh woods) knife
Preparation for experiment	With the children, collect things that have a particularly strong, characteristic smell, such as fruits, herbs, spices, and fresh wood – or bring a selection to class with you. Do not use things with a very harsh smell like vinegar, or dangerous substances like gasoline. Make sure that the children do not swallow any of the items collected.

Research question

Can our nose distinguish various smells from each other? Can we recognize something from the smell alone?

Description

This experiment should not be conducted in small groups, but together with the entire group of children.

Encourage the children to go through and describe the materials you have collected: What do they look like? How do they feel? Can you make noises with them? How do they smell on the outside and (if cut into pieces) on the inside? With the children, sort out the names of the objects.

Set up pairs of odor samples by inserting a small quantity of each item into two film canisters and covering them with wads of cotton. To make comparative smelling easier, replace the lids loosely. Ask the children to sort the film canisters into pairs with the same smell using only their sense of smell. Check the results together – do all the children agree? Come up with descriptions of the smells with the children.

Explanation

Smells are transported through the air. They generally reach the olfactory cells in the upper part of the nasal cavity by being breathed in through the nose. Each olfactory cell specializes in a particular scent. When a scent attaches to the corresponding sensory hair on the olfactory cell, an electric stimulus is triggered which, after being amplified several times, is forwarded directly to the brain and processed there. Smells and fragrances can trigger emotions and feelings incredibly quickly – joy, fear, nausea, or well-being, depending on the smell. Very intense smells also penetrate our consciousness, which means that a living being or an object can be recognized by a smell and this smell can be assigned to it. This ability is not inborn; it is learned and can be practiced. The sense of taste and the sense of smell are closely linked with each other.

Topic	Health
Phenomenon	Senses (taste)
Experiment	Taste bar (flavor test)
Available material	none
Additional material	taste samples of salty foods (for example, salt, savory snacks) taste samples of sweet foods (for example, sugar, sweet fruits, honey) taste samples of sour foods (for example, sour fruits) taste samples of bitter foods (for example, grapefruit, cocoa) a cup of drinking water per child plates
Preparation for experiment	Prepare a small “taste bar” by serving small snacks and samples of the various foods on the plates, sorted by flavor types. Find out beforehand whether any of the children suffer from allergies to any of the foods provided.

Research question

What can we taste?

Description

This experiment should not be conducted in small groups, but together with the entire group of children.

Ask the children which flavor types they know. They are bound to come up with terms such as “sweet” or “salty”. Take this opportunity to have the children taste the samples that match these flavor types. In this way, they can link a flavor experience directly and consciously with the term.

Before changing from one flavor type to the next, the children should drink a little water so that the previous flavor is neutralized.

Together with the children, try the following experiment: The children taste something sour, and then something sweet, and then something sour again – without drinking water in between. Does the perception of the sour taste change? Often, sour things taste even sourer if you have eaten something sweet beforehand.

Explanation

We perceive different flavors using sensory cells known as “taste buds”. These are located on the tongue and throughout the oral cavity. With them, we can perceive five basic types of flavor: sweet, salty, sour, bitter and umami (from Japanese: savory and meaty taste, similar to mellow tomatoes and cheese). But most flavor stimuli are combined sensations; an orange tastes both sweet and sour. Our sense of taste reacts especially sensitively to bitter substances, since these are often poisonous and are therefore dangerous to us. The sense of smell and the sense of taste are closely linked. For example, if someone's nose is blocked because of a cold, he or she often can no longer taste properly.

Further ideas

Suggest to the children that they bring foods in themselves (fruits, juices, bread, etc.) and add them to the “taste bar”. Together you can think about which of the foods tastes fall more into the salty, sweet, bitter, or sour category. The children can sample these foods to check this out, and can then sort the foods.

Topic	Health
Phenomenon	Senses (hearing)
Experiment	Xylophone made from different materials
Available material	10 hooks 1 pair of scissors 1 roll of string 2 wooden mallets
Additional material	fairly long, straight pole (for example, a broomstick or branch) on which the hooks can be securely hung method for mounting the pole everyday household objects made from a wide range of materials (cup, plastic cup, glass bottle, plastic bottle, water, stick, stuffed animal)
Preparation for experiment	Mount the pole at a height that the children can easily reach. The pole could be between two tables or chairs, for example, with just the ends of the bar resting on the chairs or tables. It should be possible to suspend several objects from the pole so that they can swing freely. For this purpose, attach pieces of string of the appropriate length to each of the objects and make a loop at the end to hang them on the pole.

Research question

Can we perceive and recognize different sounds with our ears?

Description

This experiment should not be conducted in small groups, but together with the entire group of children.

Have one child hold one object hanging from string in each hand. Ask another child to hit the two items, one after another, with the wooden mallets. How do the children describe the sounds created – are they soft, loud, high, low?

Then ask the children to sort all the items on the basis of various criteria: loud and soft noises, high and low noises, sounds that reverberate for longer and shorter times. Using the hooks, have the children hang the items in accordance with the selected sorting method so that they swing freely from the prepared pole. Can the children compose a tune on the xylophone made from different materials?

Explanation

The sounds of objects can vary in loudness, pitch, or length – depending on what material they are made of, how they are structured, and whether they can swing freely. When they are hit, the items emit sound waves that can be picked up by our auditory system, our sense of hearing. We can perceive sounds of different levels and volumes, although there are individual differences between people. Humans cannot hear all the sounds that are produced on this earth; many animals hear more sounds than we can.

Further ideas

While one child hits the xylophone, have the others listen with their eyes closed and try to guess which item has produced the sound they hear, or which material has been hit.

The children can collect a number of containers of various shapes and materials (two of each, if possible) and position them. Have the children test the sound each container makes when it is hit. Now the children can pour water into the containers. How do the sounds change as more water is added? If there are two version of one particular type of container, the children can more easily compare the sounds of the containers with and without water.

Topic	Health
Phenomenon	Senses (seeing)
Experiment	Colored tops
Available material	1 color wheel several crayons 1 pair of scissors 1 wooden dowel
Additional material	cardboard additional crayons if necessary white paper tool for making a hole in the cardboard disk
Preparation for experiment	Use a color wheel as a template to cut two to three circles of the same diameter from cardboard. Make a suitable hole in the middle of the color wheels so that a wooden dowel can be pushed through. The wooden dowel is the axis for the top. The top works best if the wooden dowel does not project under the color wheel by more than 1 cm.

Research question

How do we see patterns and colors when they move quickly in front of our eyes?

Description

Have the children test how to get the top spinning quickly. The children watch the colored disk and, together, name the colors that can be seen on it. Watch and discuss with the children what colors can be seen when the top is turning slowly, and what colors can be seen when it is spinning fast.

Encourage the children to make their own tops. For this, the children draw circles on white paper, using the templates made earlier, cut them out and decorate them with different patterns (one color or several). If a hole is made in the middle, the paper circle can be placed onto the existing top. How are the patterns seen if the top is spinning fast?

Explanation

Our eye processes light stimuli relatively slowly. If the colored top spins faster than 16 times a second, we can no longer recognize the individual colors and tend to perceive the disk as being one color, and lighter. The details of a pattern on the color wheel of the top can no longer be discerned by our eye if the top is spinning fast. We perceive a rapid sequence of more than 16 individual images as continuous movement, or as a film.

Topic	Health
Phenomenon	Senses (touch)
Experiment	Feeling memory game
Available material	1 cloth bag double-sided adhesive tape
Additional material	objects that are interesting to feel, two of each (for example, two identical or very similar stones, sticks, fruits, nuts, pine cones, pencils, cups, tree leaves, small balls)
Preparation for experiment	Put together a collection of different objects, two of each, on your own or with the children.

Research question

What do we use our hands for? Can we “see” with our hands?

Description

With the children, observe the objects very carefully, describe them in words, and agree on a name for each of them.

Place one of each pair of objects into the cloth bag. First, just insert two or three, then add others later. A child selects one of the unconcealed objects and asks a second child to find the matching object by feeling around with his or her hands in the cloth bag.

The children can also do the opposite, of course: One child feels an object in the cloth bag and describes what he or she is feeling, and the second child tries to find the corresponding object outside the cloth bag. If the children have difficulties with this, take over the “seeing” or “feeling” part.

Explanation

We perceive mechanical stimuli, in other words, physical contact, passively through our sense of touch. But we also use this sense to actively explore objects. The hand is part of our sense of touch and also a tool at the same time. We can use it to grip, stroke, build, shape, take, give, and more. If we pick up an object, we can determine its size, shape, weight, and surface characteristics. In addition, we can also perceive consistency and temperature with our hands. The palms of our hands and our fingertips are equipped with a very large number of sensory cells, which makes them very sensitive.

Further ideas

Arrange a variety of materials and substances on a stable surface (for example board, cardboard) to create a touch picture (for example, buttons, fur, carpet, sandpaper) and fix them in place with double-sided adhesive tape. Place contrasting materials next to each other. The children can explore the touch picture with their hands, with their eyes closed.

Topic	Health
Phenomenon	Sense (our skin)
Experiment	Skin as a sense organ
Available material	3 experiment containers 3 – 4 magnifying glasses
Additional material	2 – 3 plastic bags a few flat, hand-sized stones a few stones of different sizes and weights water at various temperatures
Preparation for experiment	With the children, collect a number of flat, hand-sized stones of different sizes. Find a way to warm the stones (sun, warm water, stove) and also cool them (refrigerator, basement, cold water). Make sure that the stones are not too hot. Fill the plastic bags with a little water and knot them at the top.

Research question

What can we perceive with our skin?

Description

Ask the children to close their eyes. Without saying anything, give the children either a warm stone or a water-filled plastic bag. Have the children feel the objects with their eyes closed. How does the object feel – hard, soft, warm, cold?

Have the children work together – one lies on his or her back or belly, stretches out his or her arms and legs, and closes his or her eyes. A second child carefully lays a stone on part of the body of the child lying down. Does the child lying down feel where the stone is, and whether it is a large, small, light, or heavy stone?

The following experiment should not be conducted in small groups, but together with the entire group of children.

Place three experiment containers filled with water at different temperatures in a row: cold, lukewarm, and warm (not hot!). Ask two children to dip their hands into two experiment containers, one hand in the middle (lukewarm) container and one in another container. How do the children describe the water temperature of the experiment containers, especially the middle one? Can the temperature difference also be felt with the elbows or the feet?

Explanation

The skin is our body's largest sensory organ. It envelopes the entire body and provides a boundary between the inside of the body and the environment. The skin has a number of different tasks (protection against mechanical injury and penetration by external substances, temperature regulation, detoxification by sweating, respiration, and so on).
The surface of the skin has a large number of sensory receptors with which we can perceive all sorts of stimuli: temperature (stones and water of different temperatures), contact and pressure (feeling the stones, stones on the body), pain, vibrations, tension. These sensory organs are located right under the skin. Their density and/or distribution varies from body part to body part. The most sensitive parts are the finger tips, the palms, and the soles of our feet. Our lips are also very sensitive. In addition, the thickness of the skin varies in different areas of the body.

Further ideas

A child can lie on his or her back and push up his or her sleeves and possibly trouser legs. Ask the other children to carefully place warm stones on the child's arms, legs, and/or forehead. What does the child feel?

Offer the children the opportunity to examine the skin on various parts of their body in more detail, using a magnifying glass, for example. Do the children see the little pores? Are fine hairs already starting to grow? What does an adult's skin look like? Who has birthmarks?

Topic	Health
Phenomenon	Digestion
Experiment	Gastrointestinal tract
Available material	1 balloon a few drinking straws illustration of the gastrointestinal tract (digestive system) tubular bandage
Additional material	chairs a few cups with a little drinking water some fruit/foods knife a few plates sand an old sock
Preparation for experiment	Prepare a few plates containing pieces of fruit or food snacks on your own or with the children. Fill the balloon with sand.

Research question

What happens to the food that we eat?

Description

This experiment should not be conducted in small groups, but together with the entire group of children.

What route does food follow through our body? Ask the children what they already know about it.

Have the children lie face-down on a chair; their upper bodies and heads should hang down relaxed. In this position, have them try to chew and swallow a piece of food. Does it work, or does the food slip back into their mouths? The children can also try to drink from a cup upside down using a straw.

How food passes through the esophagus into the stomach and then through the intestine can be shown in a model: The children push the stuffed balloon through the leg of the sock (= esophagus) into the foot of the sock (= stomach). Can the stuffed balloon simply slip backward? The long route through the intestine can be illustrated using the tubular bandage. The children take the stuffed balloon out of the sock (= stomach) and push it through the four-meter-long tubular bandage (= intestine). In addition, a child can lie down on his or her back, and a second child tries to place the entire four-meter-long tubular bandage on the first child’s belly. This will give the children an impression of the length of the intestine and the digestive process.

To illustrate the gastrointestinal tract, you can also use the illustration of the gastrointestinal tract (digestive system).

Explanation

Digestion starts in the mouth. Here, food is moistened, roughly chopped, and the digestion of carbohydrates starts. After this, the food does not simply fall into the esophagus; it is transported through it to the stomach through muscle movements. The stomach is an expanding “bag”, and is also the body's “mixer”. In the stomach, the puréed food is mixed with hydrochloric acid and kneaded into a pulp. The pulp passes through the intestine. The length of the intestine depends largely on the type of diet. Meat-eaters have a shorter intestine, while plant-eaters have a longer one. Humans are omnivores, and the ratio of the full length of the intestine to the length of the body is about 6:1. In children, the entire intestine is roughly four to five meters long. The intestine is made up of several sections, the most important of which are the large and the small intestines.

Topic	Health
Phenomenon	Digestion
Experiment	Our mouth
Available material	1 flashlight 1 mirror illustration of the inside of the mouth
Additional material	several pieces of fruit a little dried bread, cracker, or similar food
Preparation for experiment	Divide the bread or equivalent into small pieces. Make sure that none of the children has any allergies to the foods in question.

Research question

What is inside our mouth? What is saliva for?

Description

The children show each other their tongues and use their tongues to explore what is in their own mouths. Look at the illustration of the inside of the mouth together. Using the hand-held mirrors and flashlights, have the children try to see the details in their own mouths. Have the children look at their teeth more closely: How many do they have? Do they have different shapes? The children can bite off a piece of fruit and observe which teeth they use for biting and which teeth are used for chewing.

What do the children think are the tasks of the tongue and of saliva? Ask the children to take a little piece of hard bread into their mouths without chewing it. Does it change? Then have them start to chew the bread and look at it now and then in the hand-held mirror. What happens to the bread?

Explanation

Children have 20 milk teeth: the front and central incisors and two molars on each side. The latter are used for chewing and chopping food. The incisors cut and chop the food. Children generally start to lose their milk teeth from the age of about six, and the permanent dentition of 28 – 32 teeth is formed. The tongue plays a part in chewing, sucking, and swallowing; it has sense organs to taste and feel the food and is an important component in speech formation.
First, the saliva moistens the oral cavity, which is what makes swallowing, speaking, and tasting possible and which also influences smelling. Only when soluble substances in the food are dissolved in the saliva do we have any perception of taste. Dry food is turned into a moist purée by the saliva so that it can be swallowed and digested in the stomach.

Further ideas

Encourage the children to make lots of different sounds with their mouths. Can the children whistle, and can they click with their tongues? Daily dental care can also be included as a topic at this point.

Topic	Health
Phenomenon	Circulation
Experiment	Pulse and breathing
Available material	1 balloon 2 experiment containers illustration of heart and blood circulation illustration of the organs in the body 1 measuring cup 1 stethoscope
Additional material	1 needle stopwatch or watch with a second hand water
Preparation for experiment	You will need a place where the children can run around or at least jump or run in place. Inflate the balloon once so that it is stretched, then fill the empty balloon with water and tie it off. The experiment is ideal for performing outdoors (water splashes!). Fill one of the experiment containers with water.

Research question

What job does the heart do? How is blood transported through our body?

Description

Help the children to feel their own heartbeat and pulse and those of the others too (as long as they agree!), using their hand or the stethoscope. Explore together how physical effort affects the pulse, heartbeat, and breathing. To do this, count the pulse rate and breaths for half a minute, once when resting and then once after the children have exercised vigorously for a while (jumping, running). What has changed?

Suggest that a child tries to “pump” as fast as the heart by scooping 40 – 50 measuring cups of water from one experiment container to another in half a minute. Support the child by counting!

The prepared balloon is intended to represent the heart. Stick the needle somewhere into the balloon. Encourage the children to rhythmically press the balloon, “imitating the heartbeat”. What happens?

Explanation

Within our body, the heart is located in the left part of the chest, and primarily functions as a “blood pump”. The heart pumps the blood to the cells in the body and supplies all the tissues with nutrients and oxygen. In addition, it pumps blood through the lungs so that they can continue being “loaded up” with new oxygen. Every time the heart beats, a surge of blood is pumped at high pressure – like a little flood wave – through the arteries, which have elastic walls. The pressure wave (the pulse) can be felt at various parts of the body, for example, on the inside of the wrist near the thumb or in the neck under the lower jaw. The pulse rate is more or less the same as the heart rate. A child's heart beats faster than an adult's. The blood vessels are a circulatory system, with the blood passing through the heart several times a day. This means that the heart transports several thousand liters of blood a day through our body. The number of liters of blood in our own body can be estimated as follows: (body weight x 8)/100. So a child who weighs 30 kilograms has roughly 2.4 liters of blood in its vascular system.
During exertion, the heart beats faster and breathing speeds up too.

Further ideas

Do you or the children know any expressions that relate to the heart? What are they actually trying to express?

Topic	Health
Phenomenon	Wound healing
Experiment	Scab formation
Available material	1 cord (white) 1 cork tile 10 nails sheets of red paper 1 set of 4 illustrations of wound healing
Additional material	none
Preparation for experiment	With the help of the children, tear or cut the red paper into pieces that are not too small.

Research question

How does a scrape heal?

Description

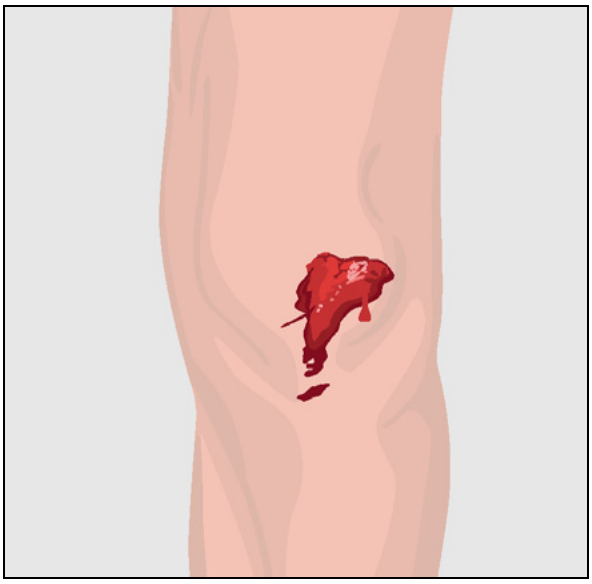
Have the children ever fallen and scraped a knee or elbow? How does a scrape or the skin around the wound change over time? Can the children put the four illustrations of wound healing into the right order?

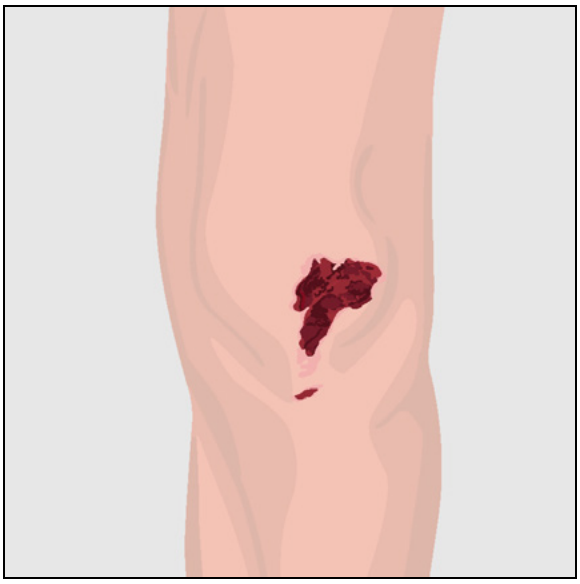
The children can also follow the healing of a scrape using a model. Have each group of children stick about 10 nails into a cork tile in a circle. The cord is tied around one of the nails and then criss-crossed between the nails – this creates a “spider web”. It becomes stabler if the cord is twisted at least once around a nail before taking it on to the next nail. If necessary, help the children with this, or the children can help each other. The end of the cord must be knotted.
The red paper pieces are then “woven into” (pushed into) the cord network.

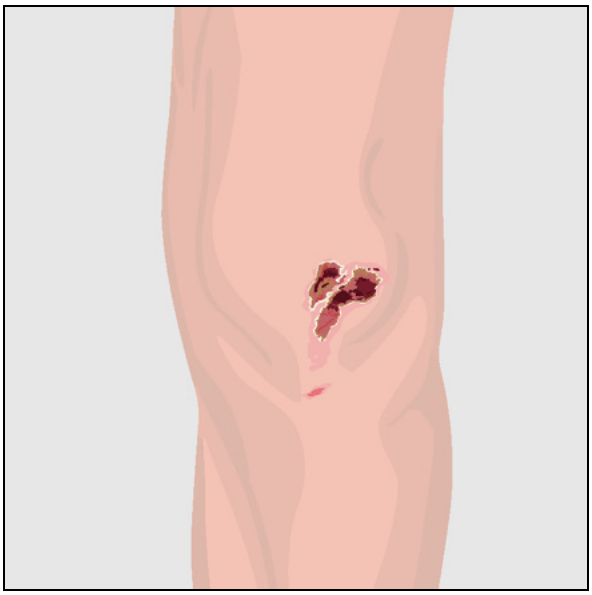
Explanation

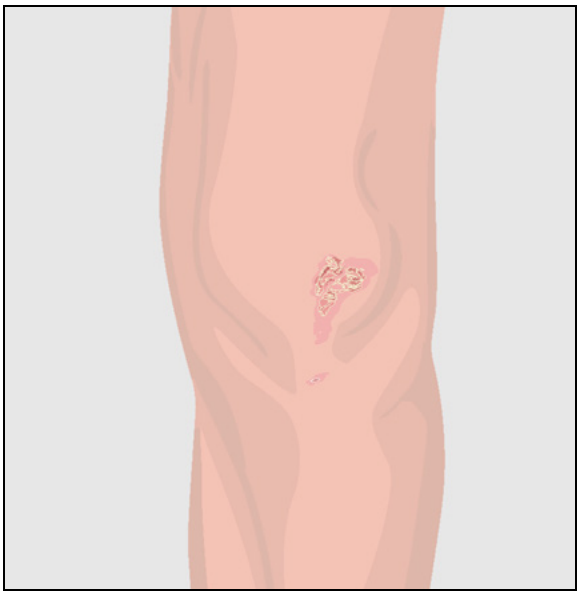
Scrapes are injuries to the surface layer of skin. As soon as the body's tissues and smaller blood vessels are injured, the blood platelets and blood corpuscles clot in the wound. In addition, threads are formed from the coagulation protein fibrin. These then form a woven network (=“spider web” of cord) in which blood corpuscles are caught (= pieces of red paper). A blood clot forms. The clot becomes more solid to create a scab. This loosens and falls off once the skin and walls of the blood vessels are healed again. The process can also be compared with a hole in a wall. Where the masonry has been damaged (= scrape), a fence is built so that no strangers (= extraneous matter, germs) can enter. Behind the fence, hard-working carpenters build the wall back up again. Once the hole is completely closed, the fence can be taken down.

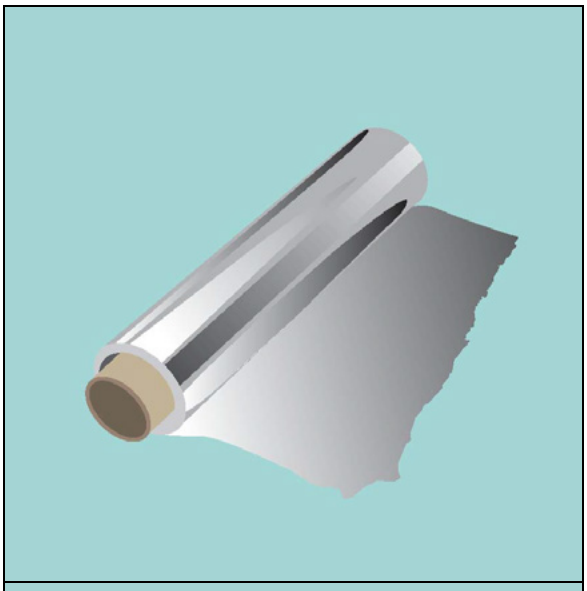
Additional material

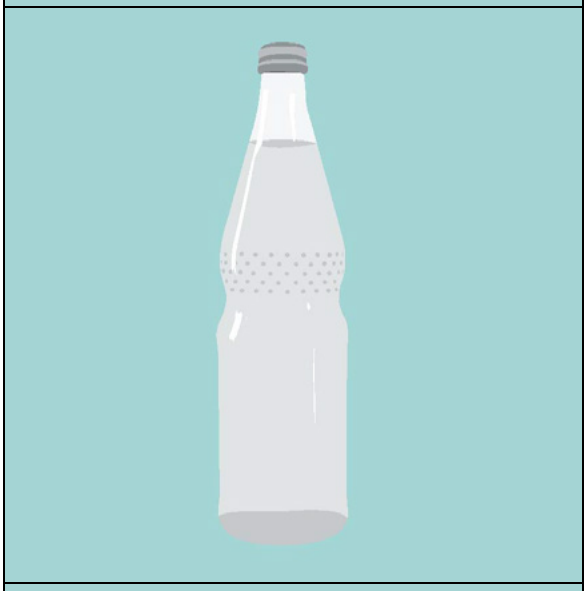


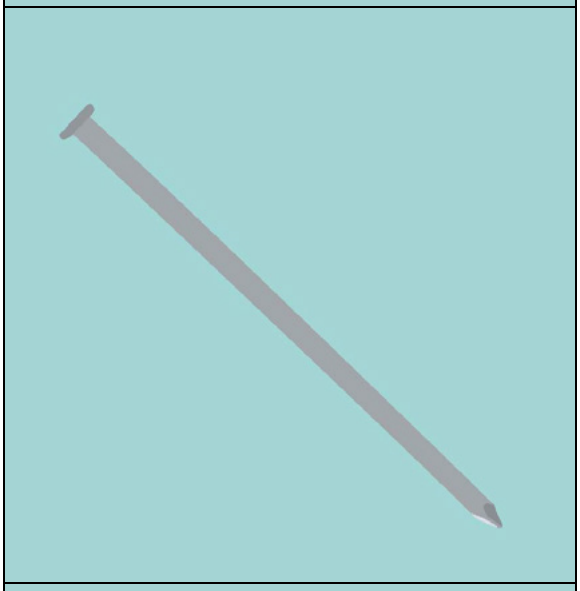


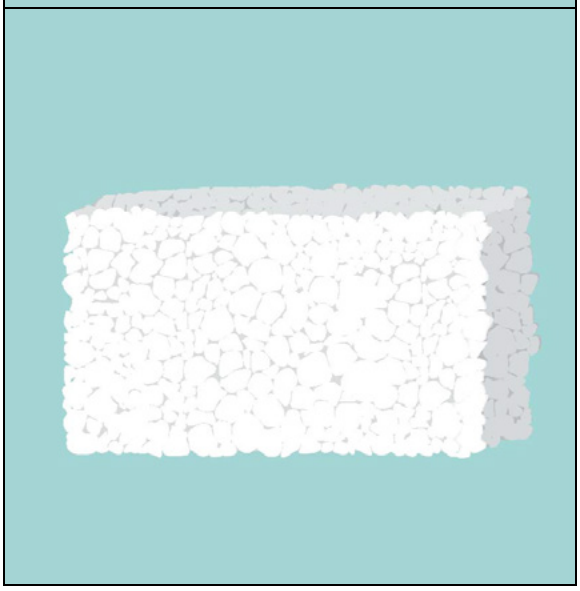


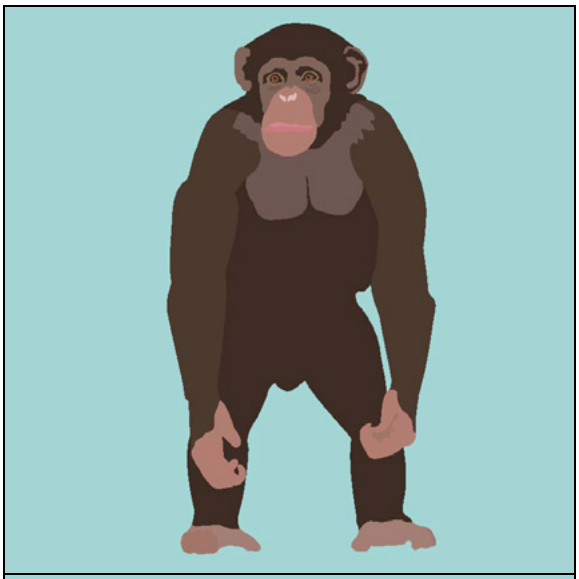


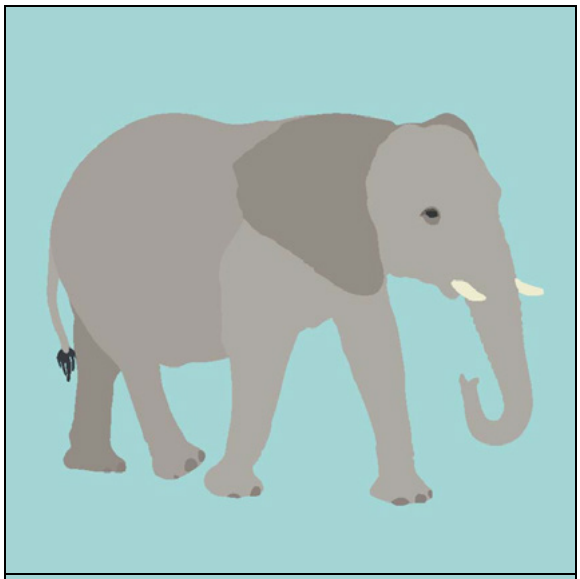


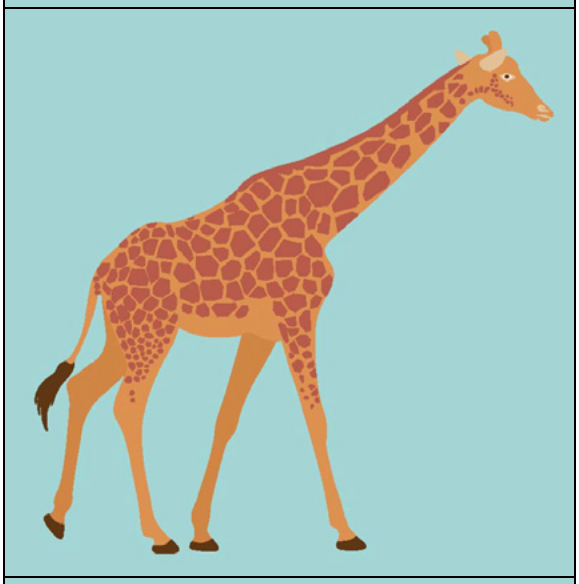


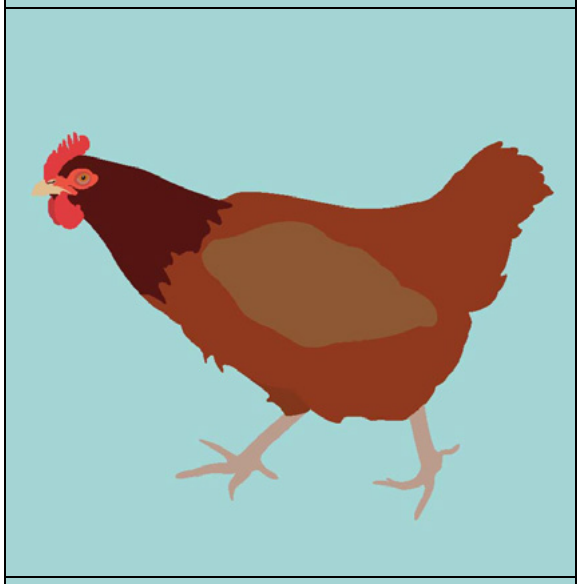


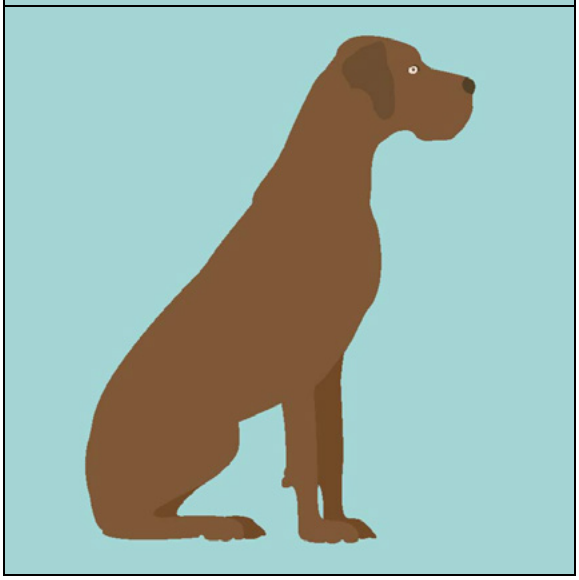


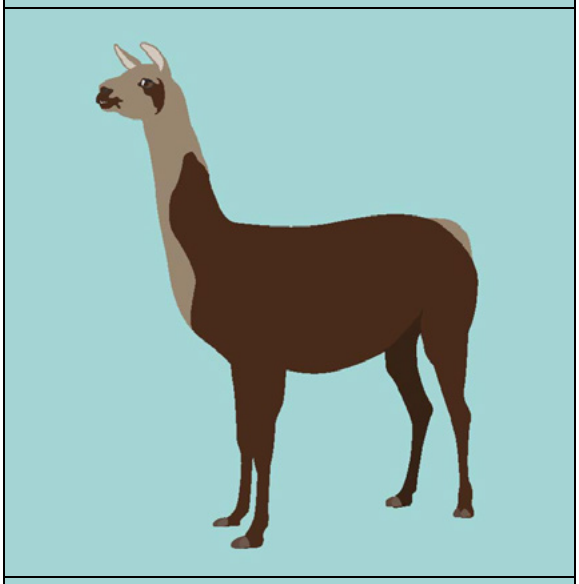


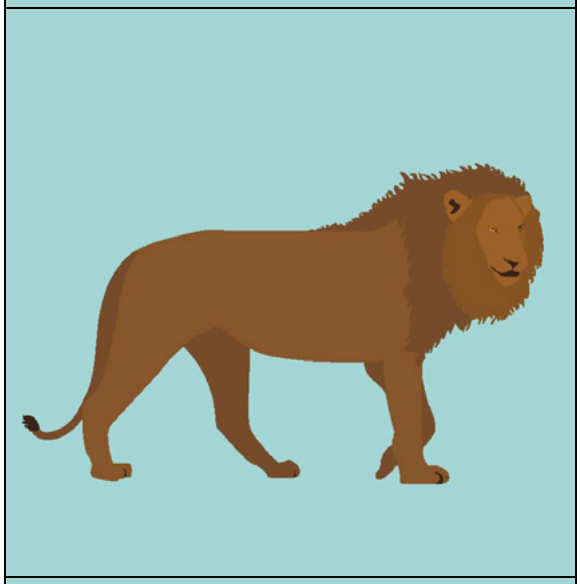


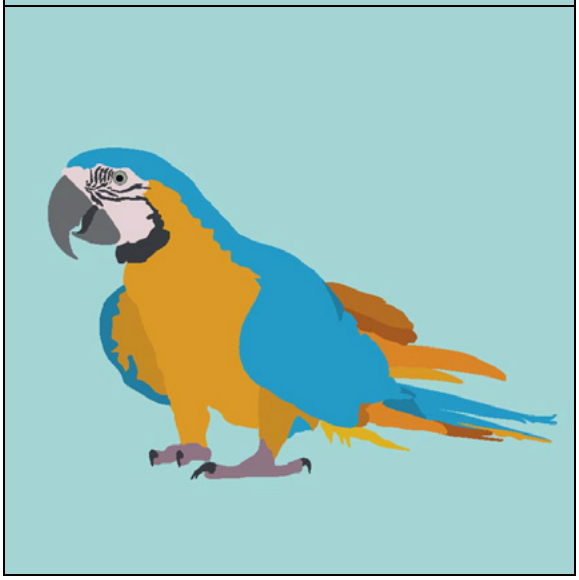


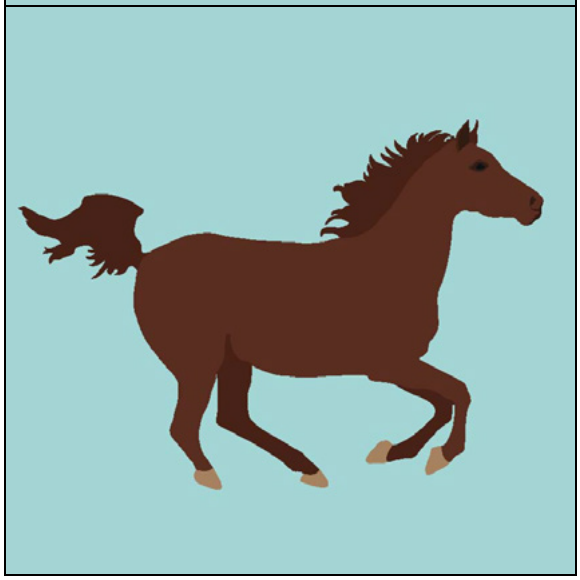


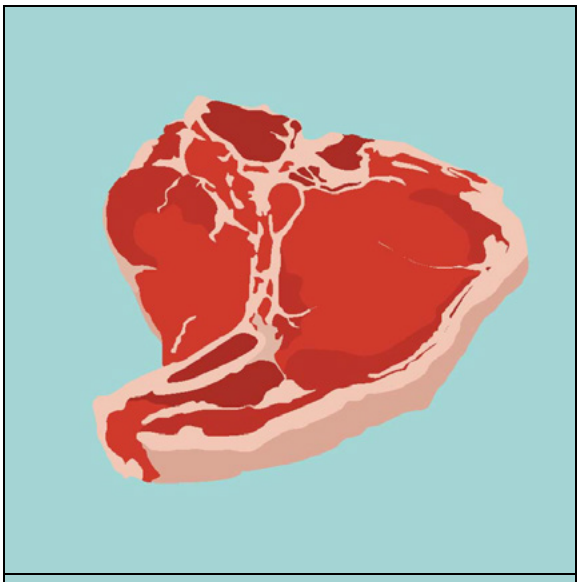


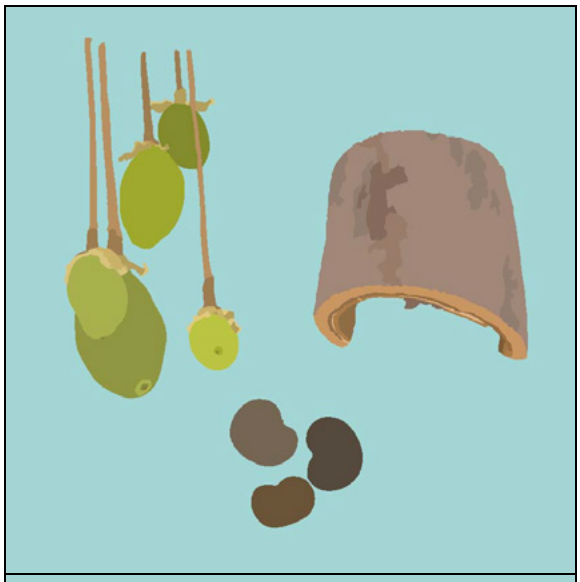


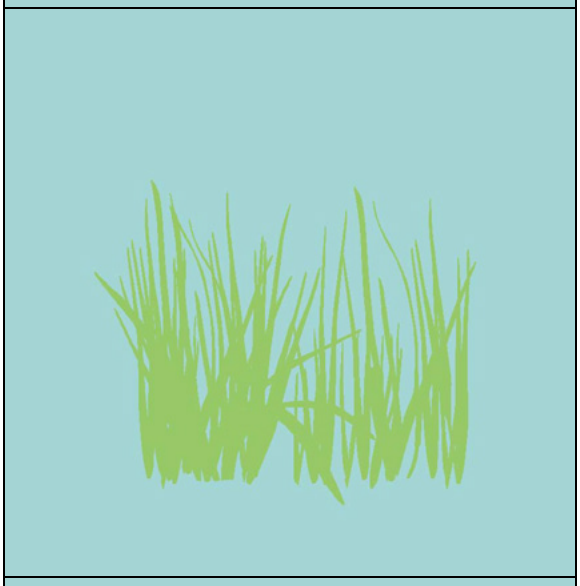


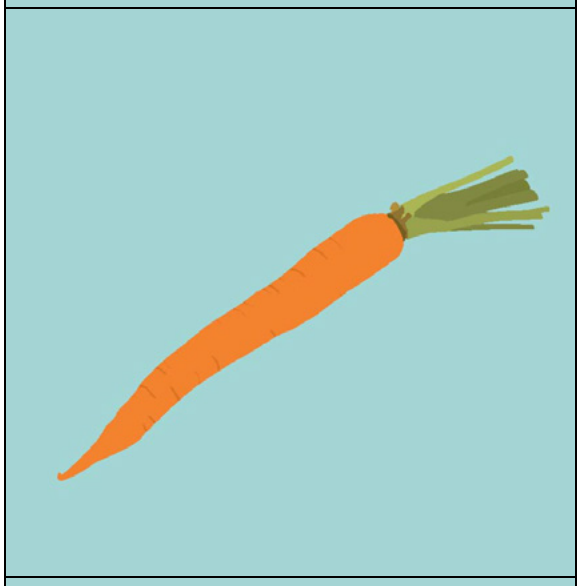


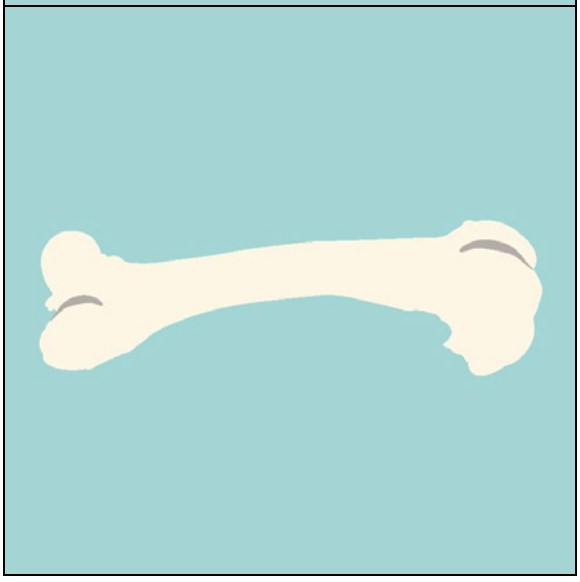


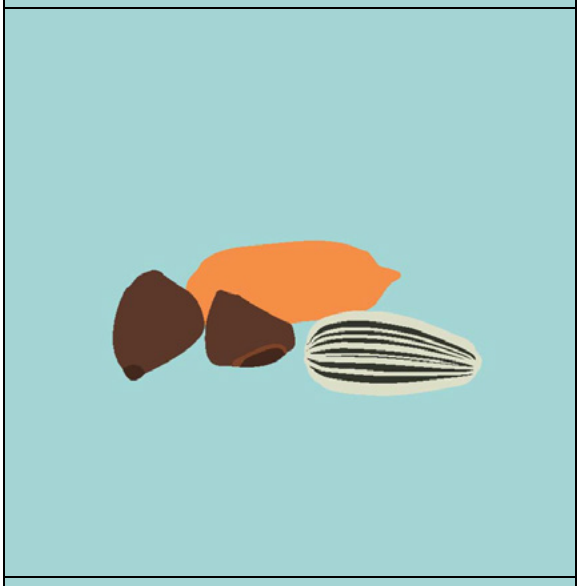


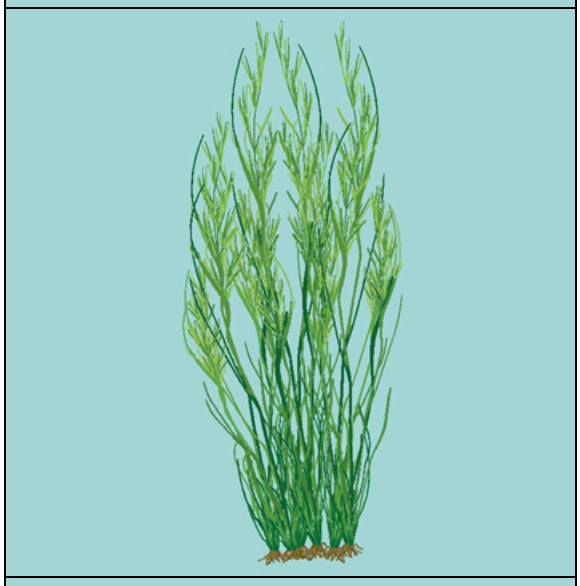


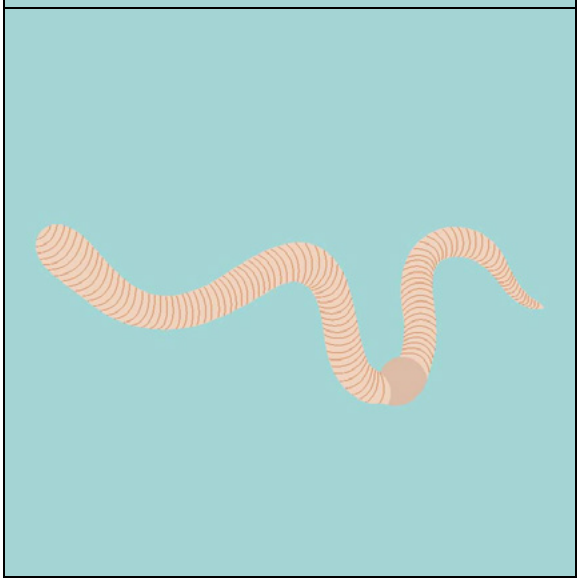


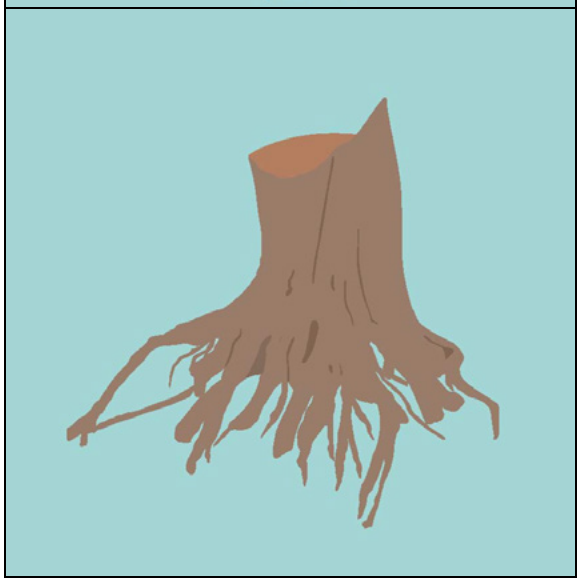




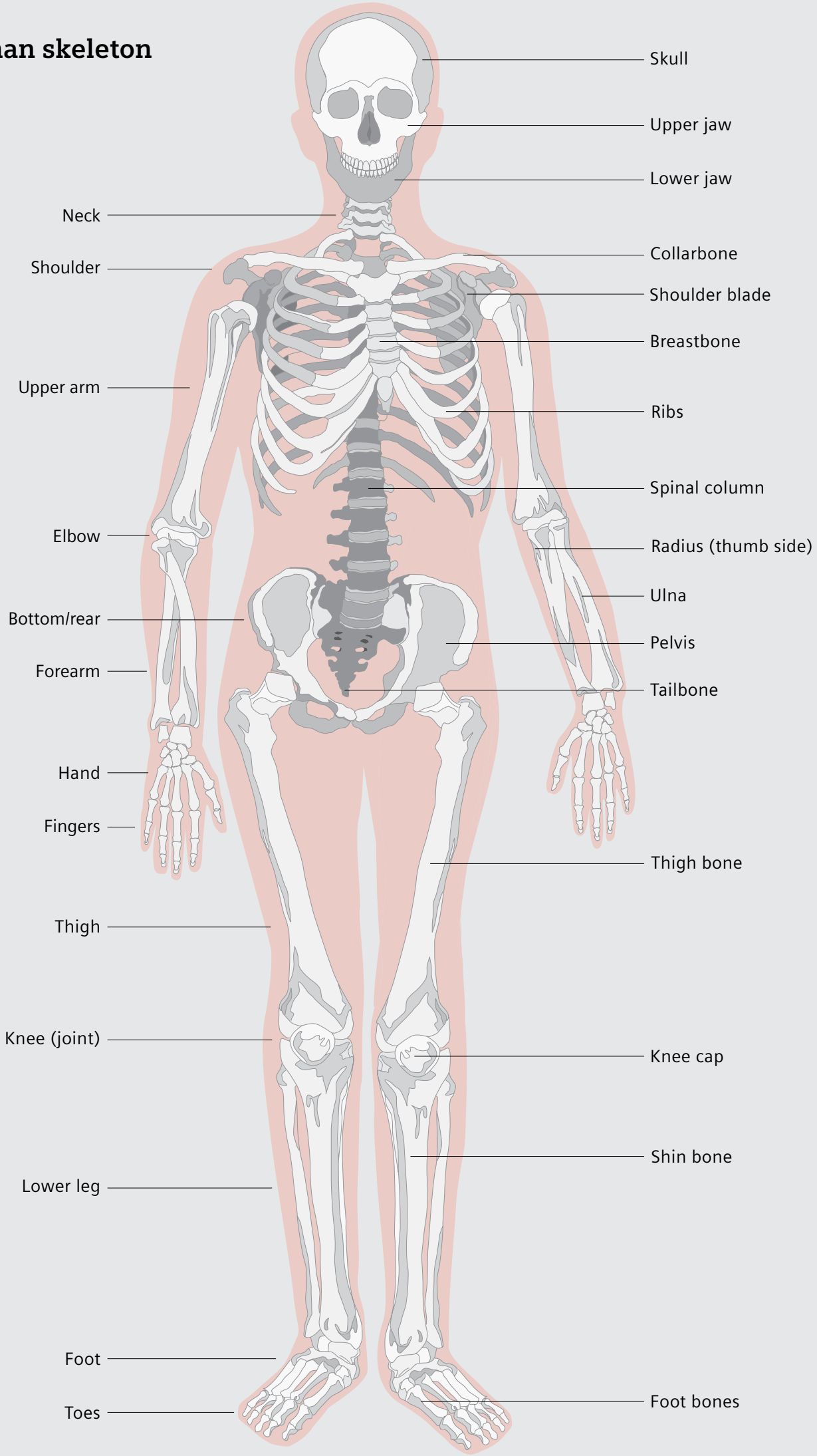




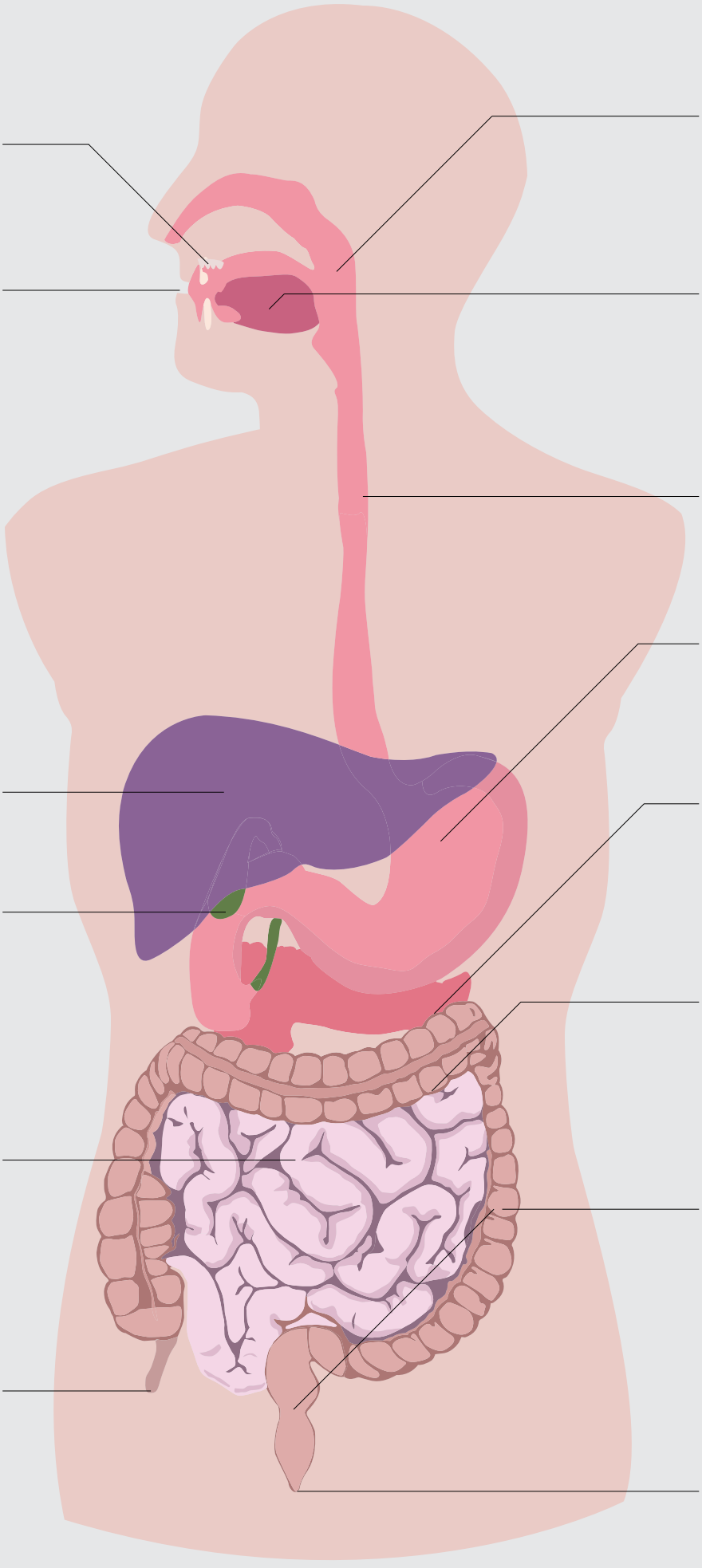




The human skeleton



The gastrointestinal tract



Teeth: chop and chew food

Mouth cavity: is moistened by saliva to make swallowing, speaking and tasting possible. It contains not only the tongue but also the taste buds, which means that the perception of taste is formed here.

Liver: processes and stores nutrients and produces bile.

Gall bladder: stores and concentrates bile which is needed to digest fat in the intestine.

Small intestine: mixes food with enzymes and bile and absorbs the digested substances into the body.

Appendix

Throat: the muscular corridor between the mouth and the esophagus.

Tongue: moves the food around in the mouth to make sure that it is thoroughly chewed and mixed with saliva.

Esophagus: transports food from the throat to the stomach.

Stomach: decomposes food and mixes it with acids and its enzymes.

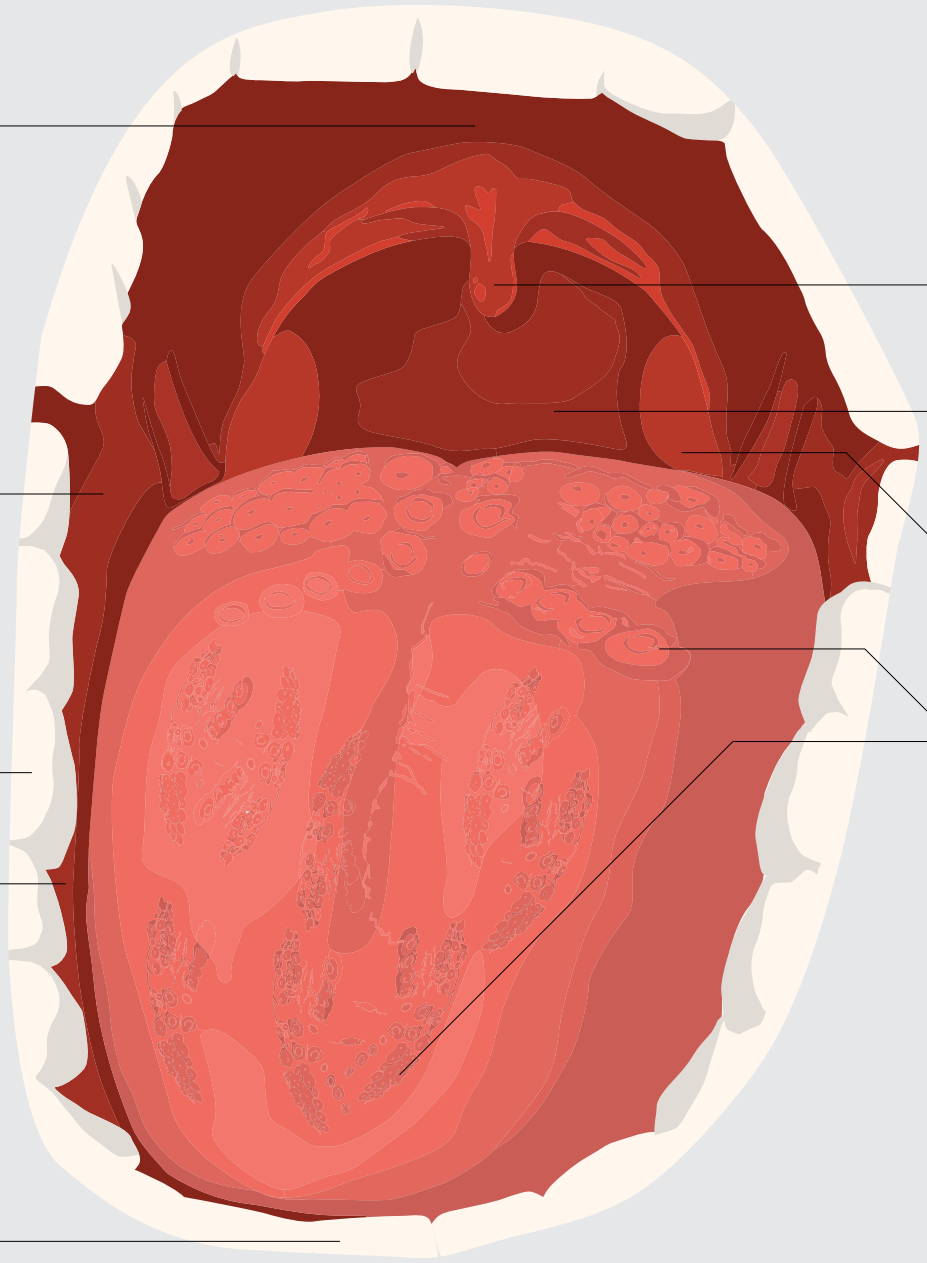
Pancreas: forms digestive enzymes which are emitted into the small intestine.

Large intestine: removes water and minerals from the digestive residues and returns them to the body.

Rectum: the part of the large intestine which forms feces from the food residues and retains it.

Anus: opens to empty out feces.

The inside of the mouth



Palate: the palate is the “roof” of the mouth cavity

Uvula: helps form the sounds needed for speech.

Throat: The throat, or gullet, is the passageway to the trachea (wind pipe) and esophagus (food pipe)

Mucous membrane

Tonsils: catch germs before they can enter the gullet.

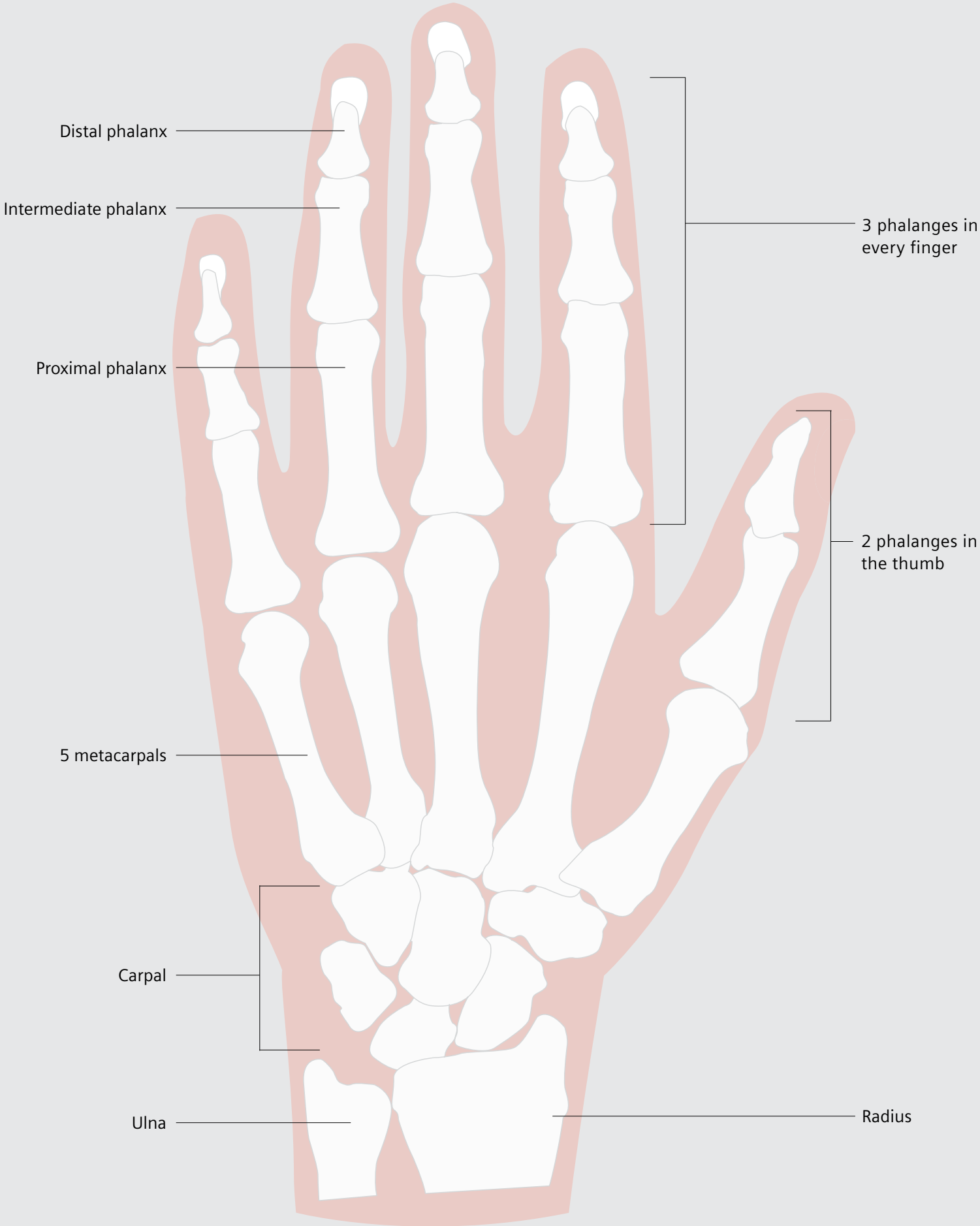
Surface of the tongue: The rough surface of the tongue consists of lots of small papillae and a few larger one in which the taste buds sit.

Molars

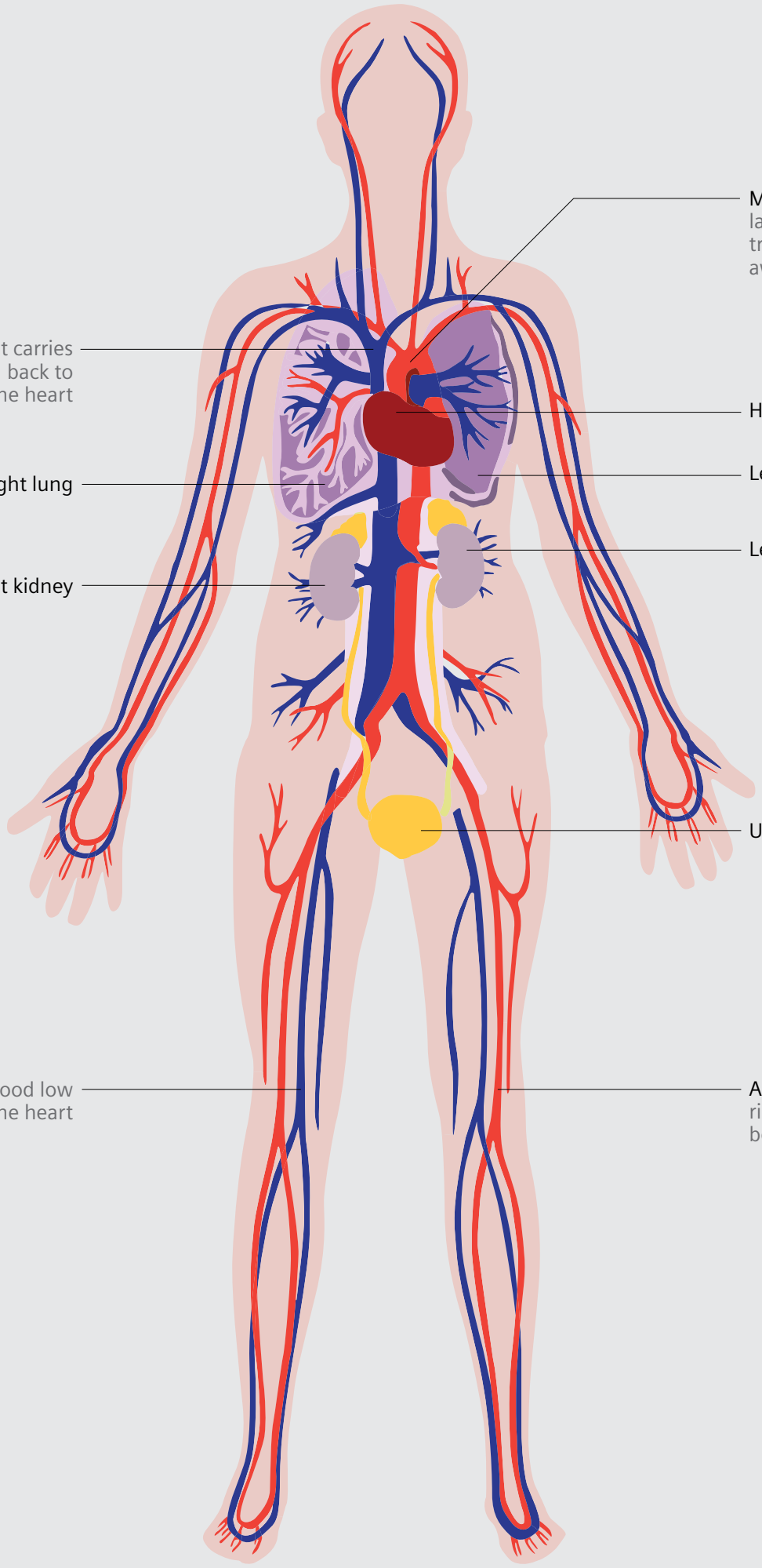
Gums

Incisors

The hand bones



The heart and blood circulation



Main artery (aorta): The largest artery in the body, transports oxygen-rich blood away from the heart

Superior caval vein: It carries blood low in oxygen back to the heart

Heart: the body's "pump"

Right lung

Left lung

Left kidney

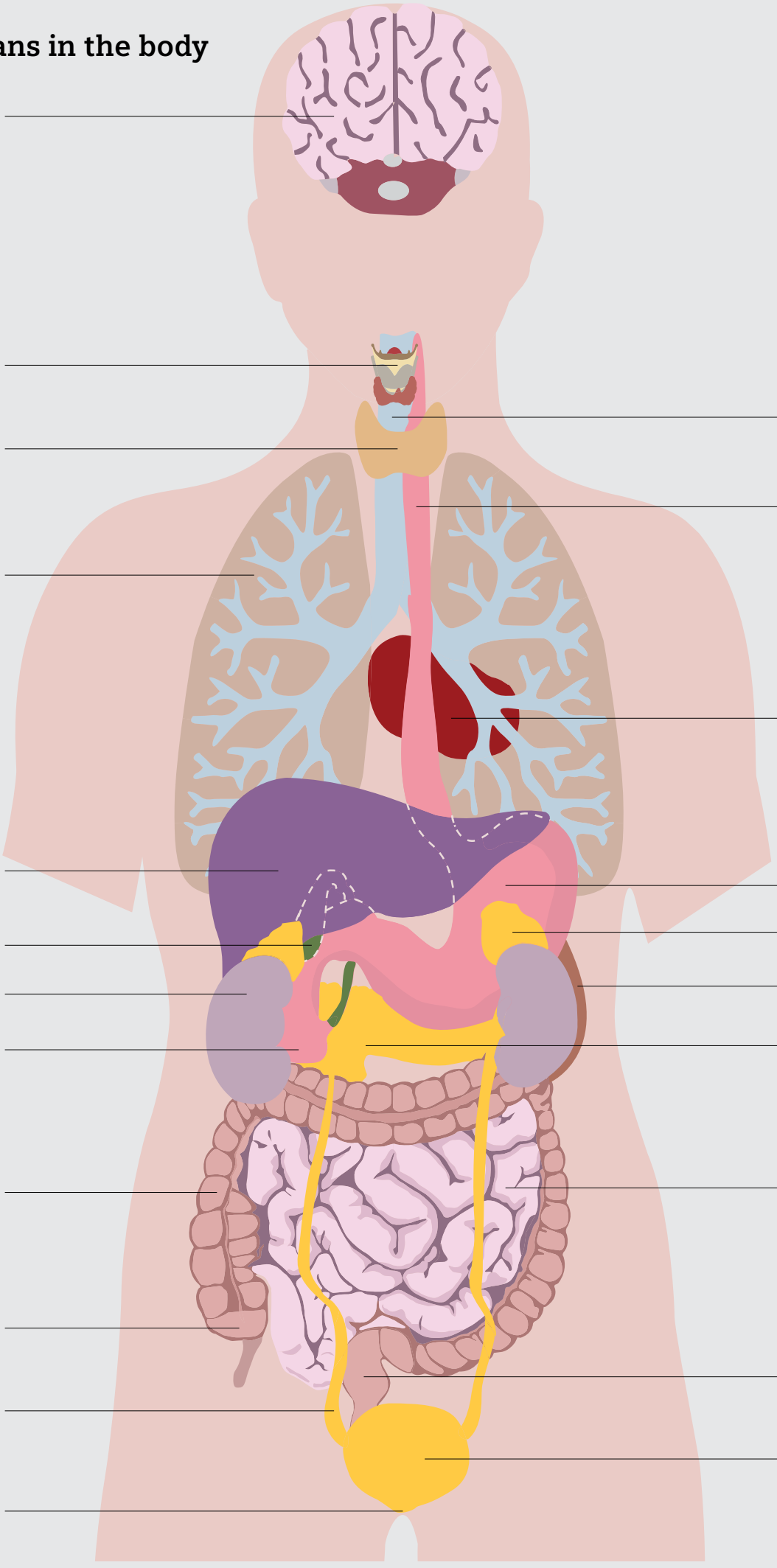
Right kidney

Urinary bladder

Vein: transports blood low in oxygen back to the heart

Artery: transports oxygen-rich blood through the body

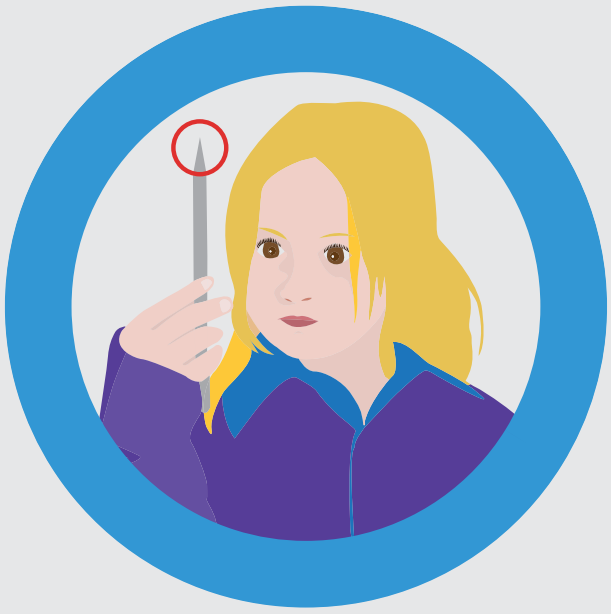
The organs in the body



Safety information

Adults must be present during the experiments!

Wash your hands when you finish experimenting!



Be careful when handling sharp objects!

Never put any materials in your mouth!

Do not eat or drink when experimenting!

Appendix

Materials, sorted by boxes

Qty.	Box 1
10	buzzer
10	electric motor
20	incandescent lamp, clear, with socket

Qty.	Box 2
10	pipette
2	scissors, left-handed pair
8	scissors, right-handed pair

Qty.	Box 3
40	cable with alligator clips
3	ink, bottle
100	nail
10	screw
10	wooden dowel

Qty.	Box 4
1	cotton
10	film canister

Qty.	Box 5
30	battery
10	battery holder

Qty.	Box 6
40	clothespin
1	cord, white
1	cream
1	double-sided adhesive tape, roll
10	hook
10	mirror
2	wooden mallet

Qty.	Box 7
12	crayon
1	glue stick
1	pencil sharpener
5	sidewalk chalk

Qty.	Box 8
30	balloon, red
1	cloth bag
10	spoon, small, metal

Qty.	Box 9
20	measuring cup

Qty.	Box 10 experiment container
5	bottle, plastic
3	flashlight
10	magnifying glass

Qty.	Box 11 experiment container
10	color wheel
5	cork tile
20	paper clip
1	stethoscope
1	string, roll

Qty.	Box 12 experiment container
5	cork tile

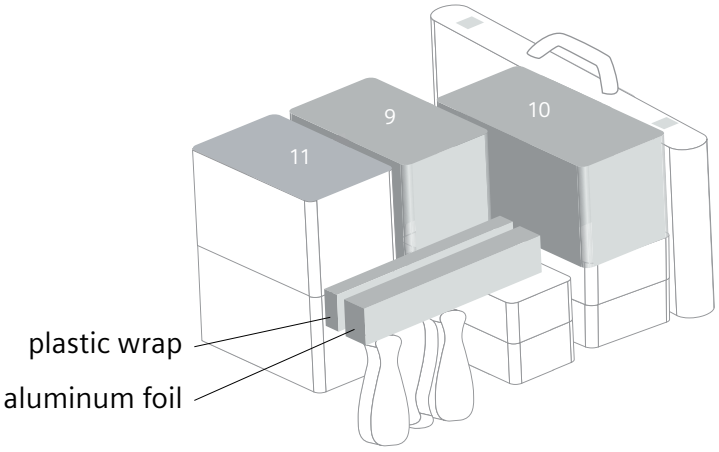
Qty.	Box 13 experiment container
100	drinking straw
100	filter paper
2	masking tape, roll

Qty.	Box 14 case
3	organs, set of pictures
10	paper, red

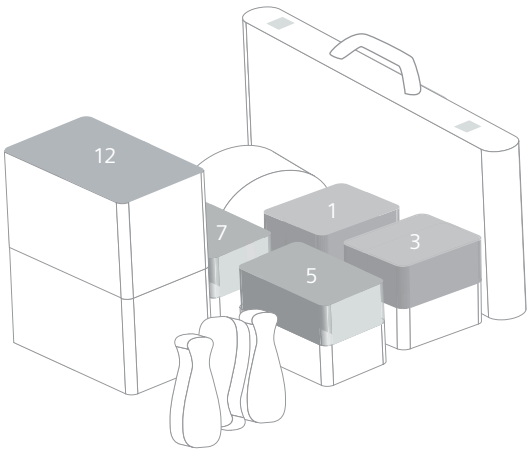
Qty.	Materials loose in the kit
1	aluminum foil, roll
3	laundry sprinkler
1	plastic wrap, roll
1	tubular bandage

Experimento | 4+
Packing instructions

3. level



2. level



1. level