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The AWESOME PHYSICS

IN YOUR HOME

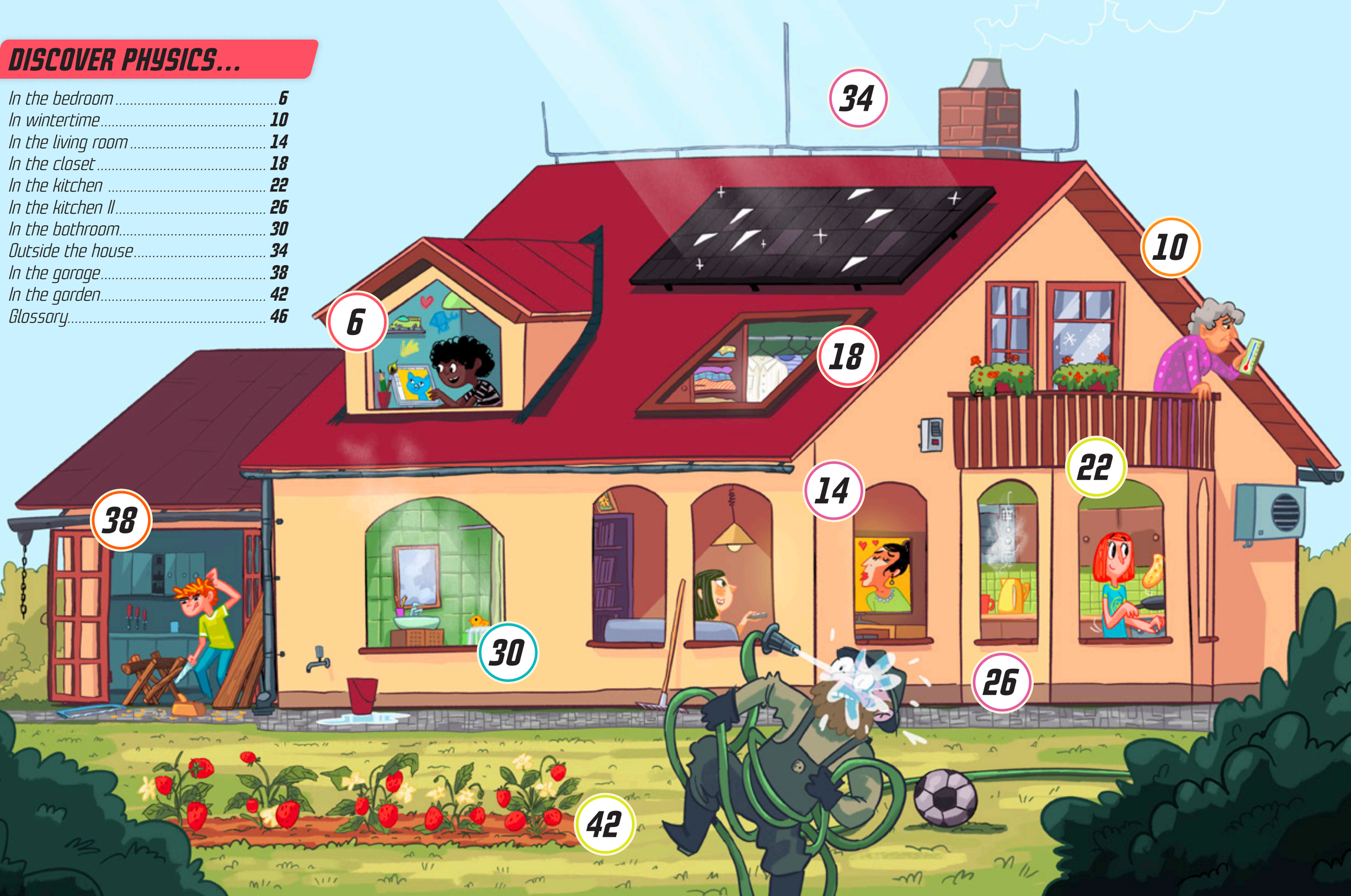
Albatros

THE AMAZING THEATRE OF PHYSICS & TOMÁŠ KOPECKÝ

THE AWESOME PHYSICS IN YOUR HOME

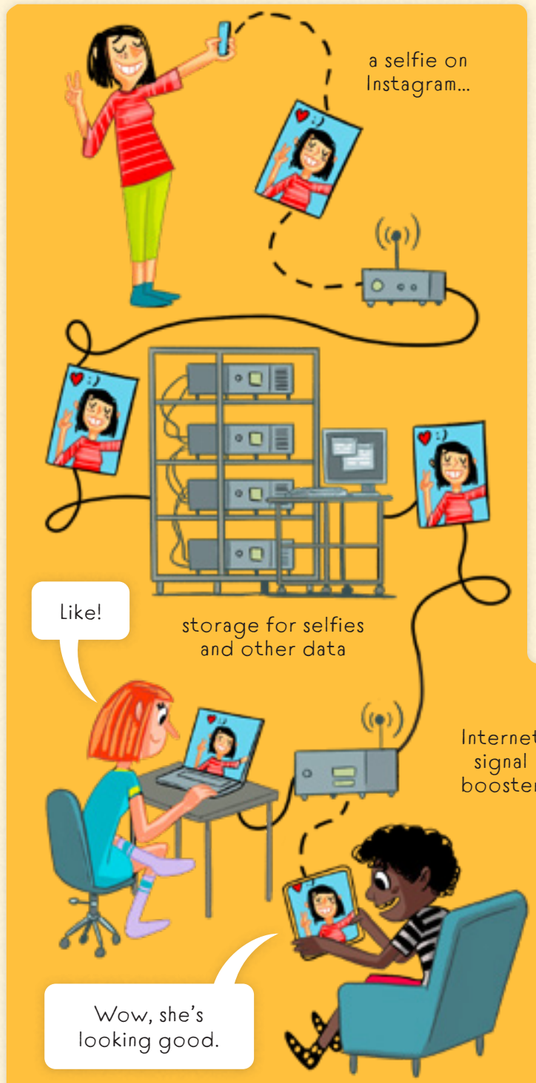
albatros

DISCOVER PHYSICS...



3 IN THE LIVING ROOM

It might seem as if there is only empty air all around us, but the opposite is actually true. If we could see things that are invisible, we would be amazed at what this empty space is full of. It is filled with warmth, smells, and different sounds. For example, when someone says hello to you, they send soundwaves into the air, which make all of the surrounding air vibrate. There is also more light than we can see shining on us from the TV and from light bulbs, and the air is full of invisible Wi-Fi signals.



Computer network

The internet is like a giant web made up of many smaller webs called networks. In the past, computers were only connected within one building or company. Later, they began to be connected across cities, countries, and even continents... and so the internet was born – a great computer network that connects the whole world. When you are browsing the internet, your computer sends a signal to other computers with different tasks. Some of them store data, others amplify this signal and process information. So, whenever you surf the web, you are connected to all other computers that are also "online".

RADIATION

The remote control

Changing the channel on the TV or adjusting the volume by pressing a button on the remote control is a piece of cake, right? But how does a remote control actually work? How does the television know exactly what we want it to do? It was easier for the earliest remote controls because they were attached to the TV by a cable. Today, though, the signal from the remote is transferred only by light. By pressing a button, you send a signal that makes a small flash of light. You can't see it, but the sensor on the TV recognizes the correct flash and changes the channel.

FLOWING

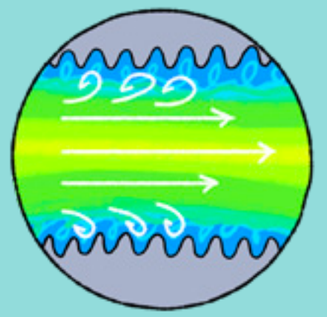
A hidden source of heat

The heating in this room is hidden in the floor, which is why you won't get cold feet in here! The heat rises from the floor to the ceiling. Radiators, on the other hand, send warm air up to the ceiling, where it gathers. More and more molecules of warm air then arrive and push the slighter cooler ones downwards.

underfloor heating

heating with a radiator

FLOWING



The noisy vacuum cleaner

A vacuum cleaner blows a stream of air through itself, picking up dirt along the way. It sucks in air at one end and blows it out from the other end. This process is controlled, so you don't have to worry about sucking all the air out of a room! Vacuum cleaners are often annoyingly noisy. Most of the noise comes from the motor and the hose. Have you ever noticed that the hose of a vacuum cleaner always has grooves in it? Why is that? Well, when the air flows through the hose, small swirls form inside the ridges. These make the air in the hose vibrate and you hear a loud humming noise. If the hose was completely smooth, it would be lovely and quiet, but it could easily snap.

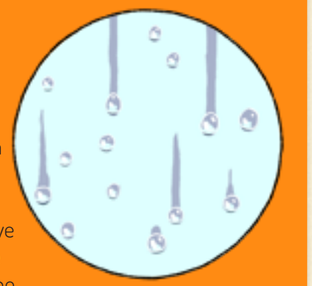
7 IN THE BATHROOM

The bathroom is like a small watery kingdom inside your home. You can explore the water in a bathtub for hours and get clean at the same time. But there are other interesting things to be found here too, such as a mirror and a tap.

CHANGES OF STATE

Fog on the mirror

It's a struggle. You take a shower, wash your hair, and then you want to comb it. Except you can't see a thing in the mirror because it's all steamed up. A bathroom is full of steam and a mirror is cold, so when the hot steam hits it, it turns into small droplets. What can be done about it? If your hair's wet and you've got a comb in your hand and you're in a hurry, you can try blowing on the mirror for a while with a hairdryer. Or give it a wipe.



precipitated water vapor

FLOWING

The water flows from the tap

When you run a bath, pay attention to the shape of the water flowing from the tap. You can get a good view of it from above the bath because the water falls into it from pretty high up. The stream of water flows downwards, gradually becoming narrower. That's because you cannot squeeze water. If you let it flow throw a narrower pipe, the water would have to speed up to keep from collecting somewhere. It also works the other way around. When water speeds up as it falls, the stream becomes narrower. And it will keep getting thinner until it splits into individual droplets.

LIGHT

A shaving mirror

Sometimes there are also smaller mirrors in a bathroom where you see yourself enlarged. This can come in handy if you want to put on make-up or pluck a hair from your nose. A shaving mirror can't be straight – it has to curve inwards like a water bowl. If you don't have this kind of mirror in your bathroom, you can try looking at yourself in a spoon or a metal ladle. You'll see that the curved shiny surface really does magnify the image!

LIGHT

A mirror image

We know that a mirror reverses an image. But how does it actually do this? After all, we don't see ourselves upside-down in it. When you raise your right hand, it looks in the mirror like you're raising your left hand. And yet it's still your right hand. When you point to the right, your image will also point to the right, as the mirror doesn't flip the image from side to side. So if you point forwards, straight in front of you, your image points at you. It almost looks like magic!

WATER PRESSURE

A bath plug

Some bathtubs have a small piece of rubber that blocks the plughole so we can take a bath. But sometimes this plug is impossible to pull out – it's held in place with tremendous force. Whenever this happens, it's because a small vacuum has developed below the plug in the pipes. More importantly, there is a lot of water above the plug and all of that water is pressing down on the plug. It doesn't matter how long or wide the bath is. What matters is how deep the water in the bath is.

8 OUTSIDE THE HOUSE

You will also find a lot of physics on the roof, on the walls, and even inside them. Try drawing a picture of a nice little house. Does it have a chimney, windows, and a door? But that's definitely not everything, is it? Do you know all of the nooks and crannies in a house and how they work?

FLOWING

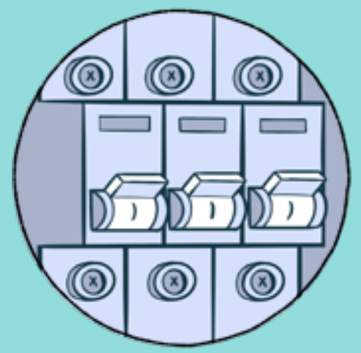
The chimney

Have you ever wondered why chimneys go up? When you fire up a stove, the air inside heats up, expands, and starts to move upwards, along with the gases produced from burning things. We call this hot, dirty air smoke. As it rushes up the chimney, it creates a draft that draws fresh air into the stove. The higher the chimney, the better the draft. And in order for it to draw properly, the smoke has to be much hotter than the air outside.

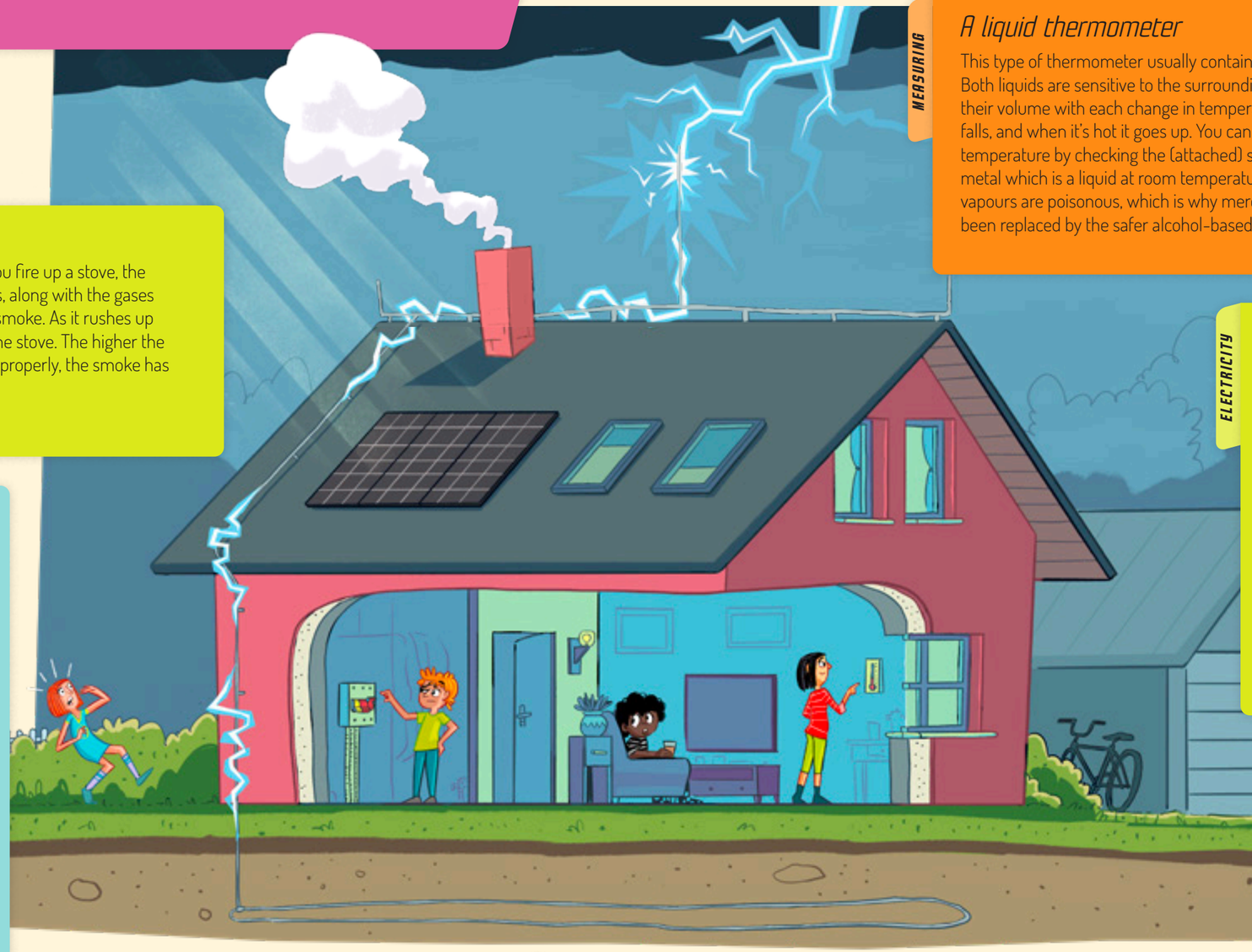
ELECTRICITY

Circuit breaker

Do you have a junction box in front of your house too? Here the electrical current that leads into your home is split into different circuits. Some devices need less of the current, so they have a lower electrical load, while others use more of it. But watch out – electric overload can easily set something on fire. If you decide to do the ironing, put on a load of washing, heat up spaghetti in the microwave, and boil water in the kettle for tea all at the same time, it's probably not the best idea. Fortunately, every home is protected by a circuit breaker, which limits the amount of current being drawn. If you plug in too many appliances, the clever circuit breaker switches off the electricity...



... so the house doesn't burn down.



MEASURING

A liquid thermometer

This type of thermometer usually contains mercury or colored alcohol. Both liquids are sensitive to the surrounding temperature and change their volume with each change in temperature. When it's cold the level falls, and when it's hot it goes up. You can easily find out the exact temperature by checking the (attached) scale. Mercury is a silver metal which is a liquid at room temperature. However, mercury vapours are poisonous, which is why mercury thermometers have been replaced by the safer alcohol-based ones.

How many degrees is it?

ELECTRICITY

Lightning rod

Most of us can't imagine living in a house without electricity. However, there is one electrical charge that no one wants in their house – lightning. That's why most houses have a protective iron spike on the roof with a cable leading down to the ground. It's not an antenna but a path prepared for lightning – a so-called lightning rod. It's always easiest for lightning to strike the highest and sharpest point. It then glides smoothly down into the ground, where the extra charge is harmlessly dispersed, allowing us to stay safe.

ELECTRICITY / RADIATION

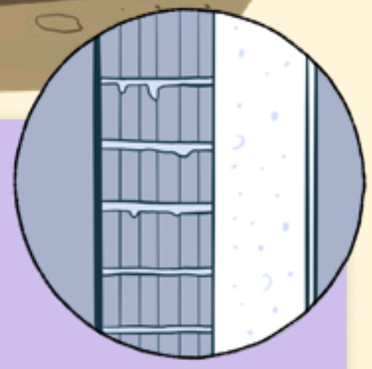
Solar panels

Solar panels draw energy from the sun. Have you noticed that there are more and more of them these days? Where do you see them the most often? The best place for solar panels is the sunny side of the roof, where they don't get in anyone's way. Although they might not be the nicest decoration for a roof, they can provide hot water or even make a home self-sufficient with electricity. In this case, efficiency wins over beauty.

HEATING

Insulation

The insulation in a home works as though the whole house was wrapped in a giant warm coat. It's there to make sure the warmth inside doesn't escape and the cold doesn't get in, and the other way round. Thanks to proper insulation, we have better control over the room temperature. Like our clothing, home insulation also makes use of a layer of air – to help us we have materials with a lot of air in them, such as polystyrene, fiberglass, foam, and even straw. Air is the very best insulator there is.



proper insulation

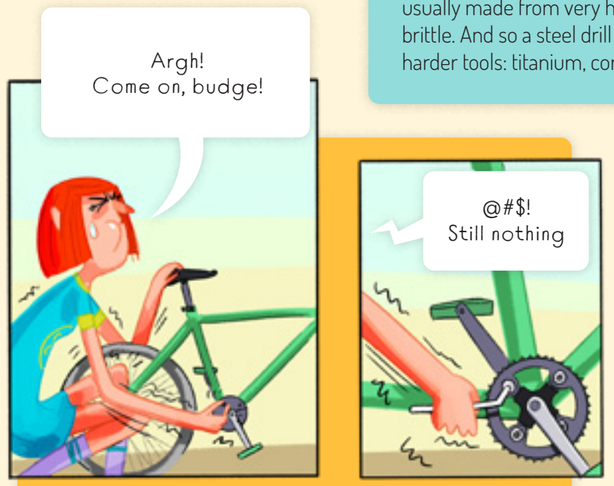
9 IN THE GARAGE

In the garage, we try to make things stronger, measure things as accurately as possible, and use the best materials. It really is amazing how much patience and ingenuity can be found in an ordinary workshop!

STRUCTURE

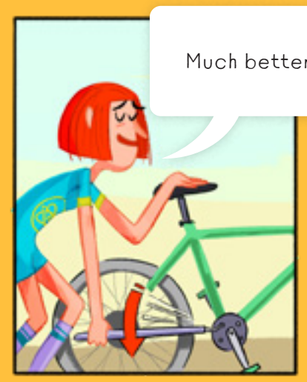
Hard and soft

There is one basic rule: the tool must be harder than the material you are working with. The saw must bite into the wood and cut the individual fibers. If the opposite was true, you wouldn't get much cutting done. A soft sawblade would soon become blunt and get ground down until it was completely smooth. This is why tools are usually made from very hard materials, like hardened steel – it is very hard but also brittle. And so a steel drill bit tends to break rather than bend. But you can find even harder tools: titanium, corundum, and even diamond.



Who tightened this?

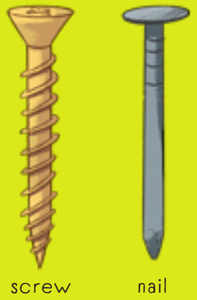
You can't loosen a nut and bolt with your fingers – it takes greater force. Wrenches, pliers, and screwdrivers all turn similarly, but they also increase the distance between your hand and the place where you are turning the screw. This is because a longer lever (meaning a tool that helps us lift or move things) increases your strength. So the next time you have problems loosening a nut, try using a longer and longer wrench.



FORCES

Sharp and blunt

We think of a nail as something sharp. But in reality, the tips of nails are blunt. When they are being made, a machine cuts off the end of some wire to create a typical nail tip. A screw, on the other hand, has to be made sharp in order to cut a thread into the wood, which we then have to unscrew it from. However, there has to be space in the wood for either the nail or the screw. If you don't want the wood to splinter, it's a good idea to drill a small hole for the nail or the screw.



MEASURING

A saw makes a great protractor.

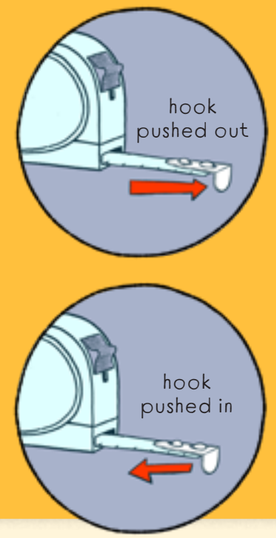
Measuring with a saw

Measure twice and cut once... But you don't always have to reach for a ruler. Sometimes all you need is an ordinary one-handed saw. You can use it to draw a straight line, but did you know it can also measure angles? Its handle is shaped in such a way that you can easily measure right angles and 45-degree angles. So the next time you want to cut a straight piece of wood or make a picture frame, a saw and a pencil are all you need.

MEASURING

A tape measure

At the end of a tape measure, you'll find a small metal hook that can move ever so slightly. If you want to measure the length of a wooden board, you can easily attach the tape measure to one end and pull. But if you want to measure a room from wall to wall, you push the tape measure against the wall.



FORCES

Get out of that hole, nail

When hammering a nail, all it takes is one wrong hit and the nail is bent. How do you get it out of the wood? Usually it's not enough just to pull at it. You can use pliers, but there's a little trick that comes in handy. Don't just pull at the nail – try to turn it slightly. The friction that is making it harder for the nail to come out will have to work in more directions at once as you twist it. It will then be that much easier to pull it out.

Fearlessly written by:
THE AMAZING THEATRE OF PHYSICS
Amusing and soothing illustrations by:
TOMÁŠ KOPECKÝ

Hey, isn't physics just another boooring science? Not at all, actually! Let's take a closer look at it – and where better to start than in your own bedroom at home. Could physics be lurking in the underfloor heating beneath your bed? Has it secretly disguised itself as a reflective T-shirt in the closet? Maybe it wandered into that dusty old fuse box that mysteriously switches itself off from time to time... And why does that happen?

Whether physics attracts you like a magnet or makes you cower in terror under your desk – have no fear and read this book. It will show you that physics can be fun and fascinating – and, most importantly, that it really can be found everywhere.

We'll gradually explore the whole house from floor to ceiling, from a happily bubbling kettle in the kitchen to a pipe with a strange bend (and an even stranger smell) in the bathroom. Along the way, we'll discover where changes of state, electricity, radiation, and all the forces are hiding. And you can look forward to amazing experiments! A word of warning, though – one of them might make your hair stand on end... literally!

LOOK!
SCIENCE IS ALL AROUND US!

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