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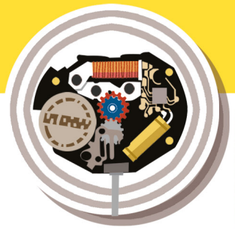
HOW DOES IT WORK?

Maddie Moate

ILLustrated by PauL Boston

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Hi, I'm Maddie.

I'm so pleased that you've picked up my book. If you've seen the title (which you probably have), then I reckon you might be curious to find out how things work. I know I am!

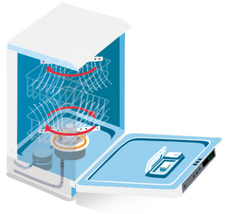
Every day, we use all kinds of objects, machines and technology, and I'm constantly asking . . .

'How does it work?'



How does a camera capture a moment and piece it back together on a screen?

Dishwashers are brilliant (less washing-up for me!), but what happens when you close the door?





And what about binoculars? They make tiny, faraway things look HUGE! Is it some kind of magic? No, it's science!

In this book, I've set out to find answers to these questions and many more. And my favourite way to learn about the world and all the things in it is by going on adventures.

An adventure doesn't have to mean travelling to faraway places. You can go on adventures in your local area, with your friends and family, and even in your own home. Adventures can be big or small – all you need is a big dollop of curiosity.

As you turn the pages of this book, we're going to go on four adventures, each with its own mission. While learning how everyday things around us work, we'll also be searching for hidden objects, spotting differences, solving mazes and helping with puzzles.

Sounds fun, right?

On page 8, our first adventure begins. My nieces and nephew have come to stay, and we're going to have a race with a remote-controlled car. But first, you need to help me find some missing parts!

What are you waiting for? Let's get started!

Stay curious,

Maddie



CONTENTS

Race Around the House	8–19
The Birthday-Party Dash	20–31
The School Trip CAT-astrophe	32–43
The Great Holiday Adventure	44–55
Things You Might Want to Know!	56–57
Glossary	58–59
Answers	60
Things to Spot!	61

Useful things to know

To help you understand how the objects and machines described in this book work, there are some things you might want to know on pages 56–57, which may be helpful to flip back to as you travel through each adventure.

Whenever you see a word highlighted **like this**, you can find a definition for it on pages 58–59, while words that look **like this** will pop up in diagrams.

You'll also find the answers to each of our adventure puzzles on page 60.

Finally – there are lots of hidden details on every page, so see how many you can spot in my 'Things to Spot' on page 61!

RACE AROUND THE HOUSE

Today we're going to have an epic race in the garden with my remote-controlled car. But there's a problem: the car is missing some of its parts! They could be anywhere – the kitchen, bathroom, bedroom, or the lounge . . .

I need you to help me find the missing pieces and put them back together. Can you spot where the car is hiding?





Breakfast Time

Good morning!
It looks like a bright, sunny day, perfect for our race.
If only we could find the car . . .
But first, let's have some breakfast. I like to start with a glass of cold orange juice straight from the fridge.

Fridge

How does the fridge keep our food cold?

It's all thanks to a clever cooling liquid called **refrigerant** that gets pushed around by a special pump called a **compressor.**

First, the cold refrigerant is pumped through tubes inside the fridge called **evaporator coils**, which take in heat from the air, cooling it down.

As the refrigerant collects heat, it warms up and ***evaporates*** – turning from a liquid into a gas, which then flows back to the compressor.

Refrigerant

Evaporator coils

ACHOO! It's dusty back here!

Condenser coils

The compressor pushes the gas particles together, making them ***vibrate*** and get hot. The hot gas is pumped towards tubes called **condenser coils.**

The condenser coils are at the back of the fridge, where it is cooler, so the hot gas ***condenses*** back into a liquid. This then flows back to the evaporator coils for the cycle to start again.

Compressor

Sometimes I make a smoothie for breakfast – my favourite is strawberry and banana!

Blender

Let's start by putting all the ingredients in the **jar**.

Strawberries

Banana

Milk (dairy or plant-based!)

Lid

Screw the **lid** on tight and press the start button.

The **electric motor** spins the **blades**, which chop up the chunky ingredients and mix them with the milk and air.

Jar

The blades on a blender are very sharp, so you should always make smoothies with a grown-up.

Blade

Electric motor

Everything whizzes round in a spiral movement, like a whirlpool! The mixture is pushed up the sides of the jar, so any big bits can fall towards the blades and get chopped up really small.

This creates a deliciously frothy, smooth liquid. Enjoy!

What a delicious breakfast! Let's be helpful and put our dirty cups and plates in the dishwasher to get them sparkling clean.

Dishwasher

Inside the dishwasher are **racks and a basket** that hold our plates, bowls, cups and cutlery.

In the **door**, you'll spot the **detergent** (soap) **dispenser**. This is for the dishwasher tablet or detergent.

When the dishwasher is full, you press the start button on the **control panel** and close the door.

If you listen, you might hear a *CLUNK!* This is the dishwasher tablet being released from the dispenser.

Racks and basket

Water inlet

Spray arms

Heating element

Pump

Drain pipe

Door

Motor

Detergent dispenser

Control panel

Water pours in through the **water inlet**. Then the **heating element** warms it.

An electric **motor** powers the **pump**, which pushes the soapy water through a pipe and out of tiny holes in the spinning **spray arms**.

Water spurts on to the dishes and washes away all the grease and food.

Finally, the dirty water is drained away, and fresh water is pumped through to give everything a rinse.

You found the remote-controlled car! But we still need to find its missing wheel. Let's visit the bathroom to brush our teeth and see if we can find it . . .

Car

Smile!

Did you know your teeth are covered in the hardest material in your body? It's called ***enamel*** and it's harder than gold, silver and even iron! But it can still get damaged if we don't clean our teeth regularly. So, let's get brushing.

Toothbrush and Toothpaste

When bits of food get stuck between your teeth, they can become a tasty meal for tiny living things called ***bacteria***. These release ***acid***, which can make little holes in our teeth called ***cavities***.

But brushing your teeth with toothpaste helps to scrub away this acid, strengthen enamel AND leave your breath smelling fresh!



What's in toothpaste?

Fluoride helps strengthen enamel.

Abrasives are tiny gritty bits that polish your teeth.

Detergents make toothpaste foamy when it gets mixed with water.

Flavours make toothpaste taste nice!

Now, where has that wheel got to? Could it be in the toilet?

Well the toilet does make things disappear – poo, wee and toilet paper!

ToiLet

A toilet has two main parts: the **cistern** and the **bowl**. When you press the **flush**, it moves a lever, which lifts the **flapper** out of a hole at the bottom of the cistern.

Clean water rushes into the toilet bowl, pushing the water with your wee, poo and toilet paper through a bendy pipe at the bottom called a **U-bend**.

When everything has been flushed away, air travels up the U-bend and makes a gurgly sound!



When the cistern is empty, the flapper closes and clean water flows back in, ready for the next time the toilet is flushed!

Don't forget to wash your hands! Ooh, that hand soap smells nice . . .

Soap

Our skin makes oil to keep it soft and healthy. But if we don't wash often, the oil builds up and can attract dirt and bacteria.

Water isn't good at washing away oil because water and oil ***molecules*** don't mix. But soap molecules have one end that loves water, and another end that is attracted to oil.

(Molecules are made from ***atoms*** – the tiniest particles that make up everything in the universe. A molecule is made from two or more atoms stuck together.)

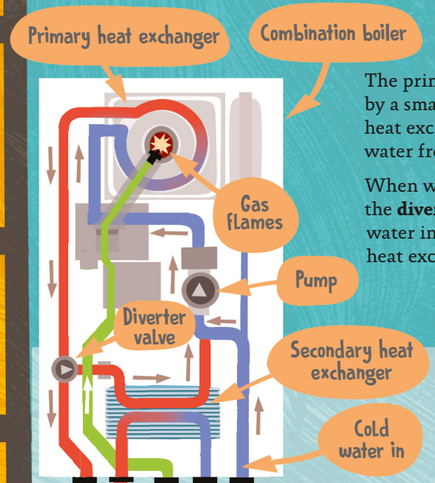


When you mix soap with oil and water, one end of the soap molecule sticks to the oil and the other end sticks to the water. As you rinse the water away, all the dirt, oils and soap go with it!

Oof, that water is COLD! I need it a bit warmer to wash my hands. But how does the water get hot?

Hot Water

Usually a combination boiler has a **primary heat exchanger** that heats water for your radiators, and a **secondary heat exchanger** that heats water for your taps.



The primary heat exchanger is heated by a small row of **flames**. The secondary heat exchanger is heated using hot water from the primary one.

When we turn on the hot tap, the **diverter valve** sends hot water into the secondary heat exchanger to warm it.

The cold water inside the secondary heat exchanger gets hot and is sent through pipes to your hot tap!



This cycle starts again every time you need hot water.

You found the missing wheel! But hang on, we're missing the transmitter that controls the car.

Let's look in the bedroom. But please close the door behind you. I just need to – ahem – use the loo.

Back to Bed

Ooh, it's lovely and cosy in here. Now, where is that transmitter?

Radiator

Radiators are normally connected to a boiler by a set of pipes.

Hot water flows in through the **inlet valve** and heats the air that passes between the radiator's front and back **panels** and hollow **flutes**.

This creates a circular movement of air, as warm air rises up and away from the radiator, while cooler air sinks down and is heated again. So the room slowly heats up!

Flutes

Panels

Return pipe

Inlet valve

Eventually, the hot water inside the radiator cools down, so the **return pipe** collects the cooled water and carries it back to the boiler for reheating.

A Very Curious Christmas

Lamp

Most bedside lamps have three main parts: a **power source**, a **lightbulb** and a **switch**. These parts are connected by **wires** to make an ***electrical circuit***.

Electricity only flows round a circuit with no gaps. When the switch is open (off), it makes a gap in the circuit. When the switch is closed (on), it completes the circuit and electricity can travel round it, lighting up the lightbulb!

But how does the bulb light up?

I should turn the lamp on. It's hard to see in this corner of the room.

LED Lightbulb

Switch

Power source (plug socket)

Wires

Most bulbs used today contain **LED chips**, which last a really long time. LED stands for 'Light Emitting Diode'.

LED chips are small electronic devices with a special ***semiconductor*** material inside. This material gives out lots of light when electricity flows through it!

Lens

LED chips

Duvet

When it's cold outside, it's lovely to snuggle up under a duvet. Have you noticed how they start cool and slowly warm up?

Duvets are stuffed with a fluffy filling, such as feathers or polyester (a type of plastic). It feels squashy because of air pockets between the strands of material. When you're in bed, your body heat warms the cooler air inside the duvet and gets trapped!

Trapped warm air

Fibres

The temperature of the air close to your skin gets warmer, in a process called ***insulation***.

Perhaps the transmitter is under the covers?

Bedsheets are also great for making a cosy fort!

The glow-in-the-dark stickers helped us find the transmitter ! But it's not making the car move. A-ha – it's missing its batteries! Let's look for them downstairs . . .

Transmitter

Glow-in-the-dark Stars

Wow, these glowing stars look super cool in our dark fort! But how do they work?

Most glow-in-the-dark stars are made by mixing materials called ***phosphors*** into melted plastic, which is then moulded into shape.

Phosphors soak up energy from light sources and VERY slowly release this energy as light in another colour – usually a spooky green – in a process called ***phosphorescence***. This weak light can only be seen in the dark – so we call it 'glow-in-the-dark'!

It's not just ceiling stars that give off a magical green glow. You might have glow-in-the-dark stickers, pyjamas or even a remote-controlled car!