

Electric Vehicles

Nowadays, electric cars are becoming more popular. They are a step in the right direction when it comes to halting climate change and can be cheaper to run. However, they aren't a modern invention. Engineers have been harnessing electricity since the 1800s. It's no surprise that they tried to use it to power carts to get around cities.

One of the first people to use electricity to power a vehicle was Robert Anderson. He built a car in the 1830s to prove that the new technology could make a vehicle move. Back then, people were used to seeing carts pulled by horses, so it was almost magical to see it move on its own. He used large batteries to power his cart, but rechargeable batteries hadn't been invented. This meant that he needed new batteries for each journey, so it was never anything other than a cool trick.

It wasn't until the second half of the 1800s that rechargeable batteries began to appear. This meant that electric vehicles didn't need new batteries when they ran out. Batteries were very expensive, so this was an exciting development.

Once rechargeable batteries came along, people began to experiment with different electric vehicles. Trams, trains and even boats were tested to see what could work. One of the first successfully rechargeable cars was built by a man named William Morrison in the 1880s. He showed it off in a city parade in 1888. It reached 20 miles per hour and could pull as much weight as four horses. It needed recharging roughly every 50 miles and used 24 batteries to run.

Electric vehicles haven't always been popular. Another man named Robert Davidson showed off a car in 1841 that could pull enormous loads. Just like Robert Anderson and William Morrison, Davidson was from Scotland. His car could travel over a mile before needing new batteries, although it was slower than walking speed. Nevertheless, people who worked on the railways were worried. One night, they broke into his workshop and destroyed the car!

The first electric vehicle that was available for people to buy



was called the “electrobat”. A pair of engineers called Pedro Salom and Henry G. Morris took existing technologies and built a battery-powered car that worked well enough to be sold. Their first model, in 1894, was extremely slow and heavy. It had wheels made entirely of steel! It took them two years to make it lighter and introduce rubber tyres. By then, it could travel up to 25 miles between charges. They eventually sold their company, which then built over 600 electric taxis to run around New York by 1905. By 1907, it had grown too big and gone bust.

During the early 1900s, electric ambulances, taxis and cars could be seen in many major cities. Unfortunately, petrol-powered cars were more economical, so most people bought those instead.

Nowadays, you can ride in many different electric-powered vehicles, from cars to trains, that can run for hundreds of miles before needed to recharge. Just remember that the idea is a lot older than you may think.

SUMMARY FOCUS

1. Which came first: Robert Anderson’s car or rechargeable batteries?
2. What happened after rechargeable batteries were invented?
3. What did Pedro Salom and Henry G. Morris do for the first time?
4. How are modern electric cars different to the first ones?

VIPERS QUESTIONS

V

Find and copy a word that tells the reader that people didn’t understand how Anderson’s vehicle worked.

I

Why might railway workers have been worried about their jobs?

R

How many electric taxis were there in New York in the early 1900s?

R

How many batteries did William Morrison’s car use?

V

What impression do you get of petrol cars from the word “economical”?

First Electric Lights

It may be a tricky idea to get your head around, but for most of human history, we lived in the dark. It wasn't until 1780 CE that people finally had access to oil lamps. Until then, nearly all of the light that people had at night came from candles. When you open your fridge and that little light pops on, it is brighter than most houses were until the late 1800s.

Oil lamps and then gas lamps became popular in the 1800s. Gas lamps were expensive and mainly only used in street lamps at first. If people wanted them in their houses, then they had to get a gas pipe fitted. These were dangerous and often exploded, so most people didn't bother. Both gas and oil lamps were a huge fire risk. What people needed was a safer way to illuminate their world.

Early lights weren't particularly successful. A man named Sir Goldsworthy Gurney found a way to use a type of stone called lime to create an incredibly bright light. His lamps burned the lime so efficiently that the light could be seen from sixty miles away. It was also the first light that could be focused into a beam or spotlight. This made them very popular in theatres - it's where we get the saying "in the limelight" from. Unfortunately, they were also incredibly hot and burned down many theatres.

Bulbs known as arc lights were invented in the mid-1800s. They used a strong electric current to create a spark between two wires in the bulb. These created an incredibly bright light and were used in lighthouses and train stations, but they were very expensive and too bright for indoors.

What inventors tried to do next was create a type of arc light that was smaller, cheaper and not as bright. They realised that adding a thin wire between the two other wires (called a filament) would solve this. Unfortunately, nobody could find a way to make a filament that didn't burn out almost immediately.

In 1840, a lawyer named Sir William Grove managed to create a filament bulb that lasted for several hours. It was still very expensive, so it never went on sale. Another man named Joseph Swan turned his hand to the problem and made some progress, but then he stopped working on it for 30 years!

In the 1870s, a man named Hermann Sprengel found a way to remove all of the air from a glass bulb. This is called creating a vacuum. Without any air, filaments



would burn for significantly longer times. An American inventor named Thomas Edison set about trying to find the perfect filament.

In 1879, Edison was finally able to show off his first bulbs. Little did he know that Joseph Swan had also been experimenting back in England. Edison showed off his design on the last day of the year, but Swan beat him by eight months!

Edison was better than Swan at organising things. His first demonstration lit up half of Manhattan in New York. He installed miles of cables and built the first electricity grid in the world. By 1882, he was able to flick a switch and light up eight hundred bulbs in eighty-five businesses across New York. The public were amazed and Edison became even more famous.

Electric lighting had begun, but it wasn't until after the First World War that people finally began to experience electric lighting in their own homes. Some of these early lights were still dangerous and sparked whenever you turned them on!

RETRIEVAL FOCUS

1. When did people finally create oil lamps?
2. Who created a way to make vacuums?
3. Which type of stone was used to make lights in theatres?
4. What were the lights used in lighthouses called?
5. What is the name of the thin piece of wire used in bulbs?

VIPERS QUESTIONS

S

How are modern houses different to those of the 1700s, according to information in the text?

S

Why was it important to find different lights to gas and oil lamps?

V

Write a definition for a "vacuum".

V

Find and copy a word that tells the reader how people reacted to Edison's display in 1882.

I

Why might Joseph Swan have been annoyed at Edison?

How Electricity Works

Electricity is a source of energy that is abundant in the natural world. Even though humans have only been using it in their homes for roughly a hundred years, that doesn't mean there was no electricity before then. Lightning is created by electricity and has been flashing from the sky since the Earth was first formed. Static electricity is the type you get when you rub a balloon on your jumper and use it to make your hair stand up. Lightning is also a type of static electricity.

All electricity is caused by unimaginably small particles called electrons. These are found in atoms, which make up everything. Electrons have what is called a "negative" charge. Atoms also contain protons, which have a "positive" charge. If you look at a battery, you will see a + and a - sign; these mean positive and negative.

Most atoms have the same number of electrons and protons. This means that they are balanced. Let's think about our balloon again. The rubber in the balloon is made up of atoms which are balanced. When you rub it against your jumper, some of the electrons are transferred from the balloon to your jumper. This means that the balloon's atoms now have too many protons, and your body has too many electrons. When you put the balloon near your hair, the negative charge of your body is attracted to the positive charge of the balloon. This makes it stick up!

Sometimes, electrons move. When they do, they take electrical energy with them. This is called an "electrical current". This is the type of electricity you get from batteries or from a plug socket. An electrical current flows through a circuit. This is made up of wires, lights, buzzers or whatever else you want to power. It might even be a fridge or a washing machine! If the electrical current can't get all the way back round to the beginning, then the circuit is "broken". If this happens, then the current won't flow at all. When you turn off a switch, you break the circuit.

If something "conducts" electricity, it means that an electrical current can flow through it. Everything conducts electricity, but



some materials are much better than others. Copper and some other metals are very good conductors. That's why wires are made from these materials. Plastic and rubber are very poor conductors. That's why plugs and wires are coated in these materials. If a plug was made of metal, you would be electrocuted every time you touched it.

The air around us is a very poor conductor. However, if the electrical current is powerful enough, then it will still conduct it. This happens when lightning strikes. Water is a very good conductor. That's why you mustn't have any electrical appliances in a bathroom. Humans are made up of about 60% water, which is why we conduct electricity really well and get electrocuted easily. It's why it's always important to be safe around electricity.

RETRIEVAL FOCUS

1. What type of electricity is lightning?
2. What are the two signs you will see on a battery?
3. Which type of particle carries electricity?
4. Give an example of a poor conductor from the text.
5. What can you rub against your jumper to generate electricity?

VIPERS QUESTIONS

V

Find and copy a word that means "equal on both sides".

S

Why do humans conduct electricity well?

S

What happens if you "break" a circuit?

V

Find and copy a phrase that tells you what size electrons are.

I

Why do you think wires are made from copper?

Powercut

Jen and Callum slouched back into the heavy cushions of the sofa. The TV buzzed into life, and the screen was filled with flickering, colourful images. It didn't really matter what was on, they had finished a day at school, and they just wanted to chill out with some cartoons. This one had a small mouse tormenting an angry cat.

Outside, the dark winter sky filled slowly with bright stars. Inside, the reflection of the TV on the windows created a strange, distorted story of its own. Suddenly, everything went black.

"What happened?" Jen cried, desperately hammering the remote control. "Where are the cartoons?"

"I don't know," cried Callum. He leapt to his feet and tried pushing all of the buttons on the back of the screen. Panic spread across his face even further when he picked up his phone. "There's no WiFi, either!"

"What are we going to do," Jen wailed. She hammered her fists against the arm of the sofa and groaned.

"Calm down, both of you," their mum said, stepping out of the kitchen with a lit candle in her hands. "It's just a power cut. We used to have them all the time when I was a girl. The wind has probably knocked down a power line somewhere."

"But there's no TV and no WiFi," Callum said, almost begging his mum to fix the problem.

"I guess we'll just have to make do," his mum replied with a smile.

"What's happened to the batteries in the torch?" their dad said, bursting into the living room. His face was red and flustered. "I put new batteries in the torch the other day, just in case this happened."

Callum looked nervous. "I may have borrowed them for my remote-controlled car," he whispered.

Dad's eyes closed, and he took a deep breath. "Do they still work?" Callum shook his head. "Fine," their dad continued. "I guess I'm nipping round to Mr Hamish's for some more." He stomped out of the living room and banged the front door shut behind him.

"What are we going to do, Mum?" Jen asked.

"There are loads of old toys and games in the attic," Mum said, pushing them gently up the stairs. "Let's go and see what we can find."

It took them a few minutes to pull the ladder down in the dark, but they were



soon ready to head up. "Not with a candle," Mum said. "There's too much stuff up there that'll catch fire."

When Dad returned with new batteries, Mum led the way up the ladder with the torch. They looked around until Callum spotted a tall box with an interesting picture on the front. "What's this?" he asked.

"That's my old Van de Graaff generator," Dad said, chuckling. "Let's take it down."

Dad took a few minutes to set up the device in the living room, using even more of the new batteries. Callum loved how futuristic it looked - a big polished metal ball on top of a towering column. He couldn't believe it was almost as old as his dad.

"Touch the ball," Dad said to Callum and Jen as soon as it was powered up.

Tentatively, they reached out until they felt a tiny tingle on their fingertips. Looking at each other, they both burst out laughing. Every single hair on their heads was sticking straight up.

Just as they finished laughing, the lights in the living room flicked back on. "Maybe I'll explain how it works another time!" Dad said.

VOCABULARY FOCUS

1. What impression do you get of how the two children were sitting from the word "slouched"?
2. Find and copy a phrase that means "relax".
3. Which sentence in the text lets the reader know that Jen was angry when the power went off?
4. Find and copy a word that describes somebody visiting somewhere for a short period of time.
5. From the word "towering", do you think the Van de Graaff generator was tall or short?

VIPERS QUESTIONS

R

Who took the batteries from the torch?

R

Why did they take them?

S

What had to happen because the batteries had been taken?

I

What evidence is there that Callum and Jen were used to watching a lot of TV and using the Internet?

I

Why might Dad not have been able to explain how the generator worked at the end of the story?



Uses Of Electricity

Electricity is a powerful source of energy that is used around the world. It can be used for lots of different things, but it can also be very dangerous. Thousands of people die or are injured by electricity each year, so it's important to always use it safely.

White Goods

“White goods” is a term that people use to describe the items in your house that are traditionally white and usually in the kitchen. These include washing machines, fridges, freezers and microwaves. These are all powered by electricity, but most of them are very modern. It took until the 1970s for more than half of the people in the UK to own a fridge. Just as the Second World War ended, only 2% of all people owned one! Washing machines as we know them, where you can set them on a timer and leave them to it, didn't appear until the 1980s!

Televisions and Entertainment

Before electric washing machines and fridges, people got by with manual machines and pantries. There was an alternative, even if it wasn't as effective. Before electricity, there wasn't an alternative to television or most modern entertainment. There were no computer consoles powered by gas. Radios needed electricity to work, and before batteries, there weren't any of those, either. BBC broadcast the first television show in the UK on the 2nd of November, 1936. It took until the 1960s before most houses in the UK had their own TV set. The first computer console was released in 1972, but the first popular console was the Nintendo Entertainment System in 1983.

Saving Lives

The human body is powered by electricity. Our cells are some of the best conductors in the universe. The nerves in our bodies use electricity to send messages to our brains. Whether you hurt yourself or somebody tickles you, that message is sent through an electric current. A special part of your heart uses electricity in the pumping of blood around your body. This happens between 60 and 100 times a minute - it's called your pulse rate. Sometimes,



this goes wrong, and your heart starts to beat in strange patterns. This is called an “arrhythmia” (it’s pronounced ay-rith-me-ah). You might have seen paramedics using a defibrillator to send an electric shock through somebody’s heart when they have a heart attack. This stops the heart and allows it to restart, hopefully beating normally again.

Dangers

The fact that the human body relies on electricity is what can make it so dangerous. If you suffer an electric shock, it can disrupt your heart beat or damage your nerves and stop them from working. If your nerves don’t work, then your brain might die or your heart might fail. Electricity also causes a lot of heat. A big enough electric shock can cause serious burns. Always make sure that you are following an adult’s instructions whenever you use electricity.

RETRIEVAL FOCUS

1. How many people are killed or injured by electricity each year?
2. How many people in the UK owned a fridge at the end of the Second World War?
3. When were modern washing machines invented?
4. What was the first popular gaming console?
5. Where is electricity used in the body?

VIPERS QUESTIONS

S

How does a defibrillator work?

V

What does the word “modern” tell you about something?

V

If something is “manual”, what do you think it means?

I

Why didn’t many people watch the first BBC broadcast?

V

Find and copy a word from the “Dangers” section that means “interrupt” or “get in the way of”.

Answers - Electric Vehicles:

1. Robert Anderson's car
2. People started to experiment with creating different kinds of electric vehicles
3. They produced the first electric vehicles that could be sold
4. They travel for hundreds of miles without recharging and go a lot faster

V: Magical

I: The new vehicles could carry lots of weight and they might have been worried that people wouldn't need trains anymore

R: Over 600

R: 24

V: Costs less money

Answers - First Electric Lights:

1. 1780 CE
2. Hermann Sprengel
3. Lime
4. Arc lights
5. Filament

S: They are much brighter and with safer lighting

S: They were dangerous and caused lots of fires

V: A place where all of the air has been removed

V: Amazed

I: He also created a working light bulb but Edison became famous

Answers - How Electricity Works:

1. Static
2. Positive and negative (+ and -)
3. Electrons
4. Plastic or rubber
5. A balloon

V: Balanced

S: We are made up of lots of water and water is a good conductor

S: You stop the current from going all the way round it, so electricity stops flowing

V: Unimaginably small

I: Copper is a good conductor and we want wires to conduct electricity

Answers - Powercut:

1. They were comfortable and leaning back into the sofa
2. Chill out
3. She hammered her fists against the arm of the sofa and groaned.
4. Nipping
5. Tall

R: Callum

R: To power his remote-controlled car

S: It meant that Dad had to go to the shops to buy more batteries and they had to wait before they went up into the attic

I: They got angry and panicked when the power went off and they couldn't use the WiFi

I: He knew that the children would go straight back to the TV and their devices now that the power was back on

Answers - Uses Of Electricity:

1. Thousands
2. 2%
3. 1980s
4. 1983
5. Nerves and your heart

S: It stops a person's heart from beating so that it can restart with a normal beat

V: It is from recent times

V: You have to use your own hands or strength to get it to work

I: Not many people owned a TV at the time

V: Disrupt