Ingenious Inventors

29th June -3rd July

Graham Alexander Bell

LO: I can describe Alexander Graham Bell and his inventions.

Success Criteria

- I can describe Alexander Graham Bell's life.
- I can explain what Alexander Graham Bell invented.
- I can present what I have found out about Alexander Graham Bell

Alexander Graham Bell

Early Life

Alexander Bell was born in March 1847 in Edinburgh, Scotland.

He had two brothers, Melville James Bell and Edward Charles Bell.

Bell's father, Alexander Melville Bell, was a phonetician, which is a scientist who studies speech sounds and how they are made and transmitted.

His mother was Eliza Grace Bell, and she was an accomplished pianist.

Bell was home-schooled by his mother, who tried to give him a sense of curiosity about the world around him.

To his close friends and family, Alexander Bell was known by the nickname Aleck.

Alexander Graham Bell

First Invention

Bell was very curious about the world at an early age and had a great ability to find solutions to problems.

The family of his friend and neighbour, Ben Herdman, ran a flour mill. While visiting the mill, Bell noticed the slow process of de-husking the wheat grain.

At age 12, Bell built his first invention to solve this problem. He created a device with rotating paddles and nail brushes that made it much easier and quicker to separate the grain from the husks.

His device was used in the mill for several years! As a thank you, the mill's owner, John Herdman, allowed Bell to use a small workshop at the mill to create more inventions.

Alexander Graham Bell

The Telephone

In the early 1870s, Bell was living and teaching in Boston, America. He spent years trying to develop a device to transmit the human voice over electrical wires.

On 10th March 1876, he began working with Thomas Watson, a skilled electrician. Together, they continued experimenting and developing a way to transmit speech.

On March 10th 1876, Alexander and Thomas were working in separate rooms. Bell made the first ever telephone call, saying "Mr Watson, come here. I want to see you!"

Following this success, Bell began to demonstrate his telephone in a series of public shows.

The Bell Telephone Company was set up in 1877, and by 1886 over 150,000 people in the USA owned telephones.

Examples of Bell's early telephone equipment.

Alexander Graham Bell

Work with Deaf People

Alexander Graham Bell's mother was deaf.

Bell's father worked with deaf people, and developed a system known as 'Visible Speech' to show how different speech sounds are made. At that time, Visible Speech was thought of as an excellent way to help deaf people learn and develop their speech, although its use gradually stopped after about twelve years.

Bell helped demonstrate how Visible Speech could be used, and helped his father teach it to deaf people.

In 1871, Bell travelled to Boston in America to train teachers at the School for the Deaf.

In 1872, he opened his own School for the Deaf. His first class had around thirty pupils, including Helen Keller, who became the first deaf and blind person to earn a university degree.

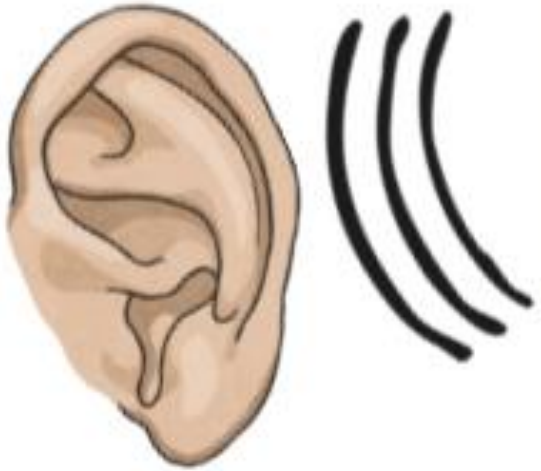
Alexander Graham Bell

Work with Sound

While working with his father, Alexander Graham Bell became very interested in speech and how we make sounds.

He and his brothers invented an 'automaton' - a mechanical man. Using bellows to push air through its windpipe, they could make it 'speak' a few words. Their neighbours all came to see and were amazed by it!

At the age of nineteen, Bell conducted some experiments with tuning forks, to explore how sounds are transmitted. He wrote a report of his findings and sent it to his father's colleague, Alexander Ellis. Ellis wrote back to tell Bell that his experiments were similar to some that had already been done by Hermann von Helmholtz in Germany, and sent him a copy of the report of those experiments.



Bell was very disappointed that Helmholtz had already published his ideas. He read his report and came up with a new idea based on Helmholtz's work. He started to concentrate on using electricity to transmit sound.

Alexander Graham Bell

Controversy

Alexander Graham Bell was not the only person working on the telephone during the 1870s. Several scientists claimed that they had actually invented the first telephone, not Bell.

Bell had filed a patent for his telephone in February 1876. A patent is a document that gives an inventor the right to prevent other inventors from making, using or selling the same invention without asking.

On the same day, a scientist called Elisha Grey had filed a patent caveat. This was not a full patent, but was a document to show that he would soon be filing a full patent.

Later, Elisha Grey felt that Alexander Graham Bell had stolen his ideas and used them to get his telephone working. This had to be investigated by the patents office.

Bell's claim to be the first inventor of the telephone was eventually approved in March 1876, and Grey abandoned his claim and his caveat.

Bell had to continue defending his idea from other scientists who claimed they had thought of it first. Over eighteen years, the Bell Telephone Company faced over 550 patent challenges. None were successful and Alexander Graham Bell is still regarded as the inventor of the first successful telephone.

Alexander Graham Bell

His Legacy

As the telephone became more and more important, so Alexander Graham Bell became more and more famous. He received many awards, medals and honours for his invention.

There are many museums and parks named after him, and Bell's house in America is preserved as a historic site.

As Bell's wealth grew, he used some of his money to set up laboratories and funds to help other scientists and young people.

He set up a centre for study and research into deafness which is still active today in Washington.

Bell founded and became president of many societies, such as the National Geographic Society.

The measures of sound, the bel and the decibel, are named after him.

Bell died in 1922, aged 75. After his funeral, every telephone on the continent of North America was silenced as a mark of respect for him.

Using the slides above, create a informative poster about Graham Alexander Bell in your book.

Maria Telkes

LO: I can build a solar oven and explain how the temperature changes inside it.

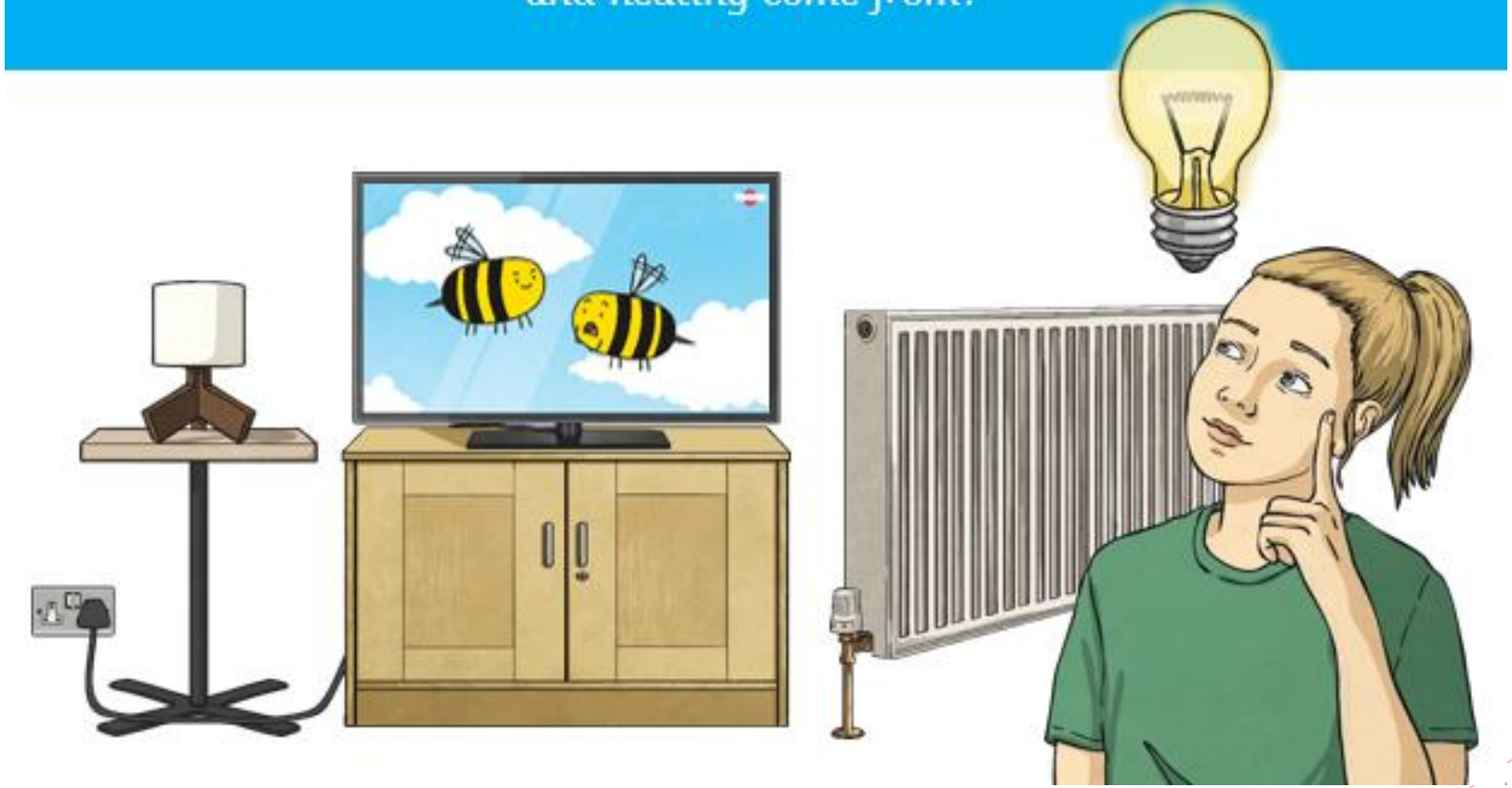
Success Criteria:

- I can identify the achievements of Maria Telkes.
- I can explain how the sun's energy can be used to heat things.
- I can explain why solar power is a good source of energy.
- I can accurately read the scale on a thermometer.

We've Got the Power

Whole Class

Think about how you get power to your home. Where do your electricity and heating come from?



Solar Power

The word 'solar' is used to describe something related to the sun.

If something is solar powered, it means that it runs off the energy we get from sunlight.

Some people have solar panels on their house so that some of their electricity comes from the sun.

Solar Power

Often, we get our power from fuel sources dug out of the ground, which will one day run out completely. However, solar power is a renewable energy source, which means that it will not run out – just like wind or water power.

Although it costs us money to build the equipment which will harness solar power, sunlight itself is free!

Can you explain why people might prefer solar, or other renewable energy sources, to fuels from the ground?

Maria Telkes

Maria Telkes is a famous scientist who made lots of discoveries around solar power. She was born in Hungary in 1900.

She is best known for creating the first house built with a heating system that ran completely on solar energy – The Dover Sun House – with the architect Eleanor Raymond.

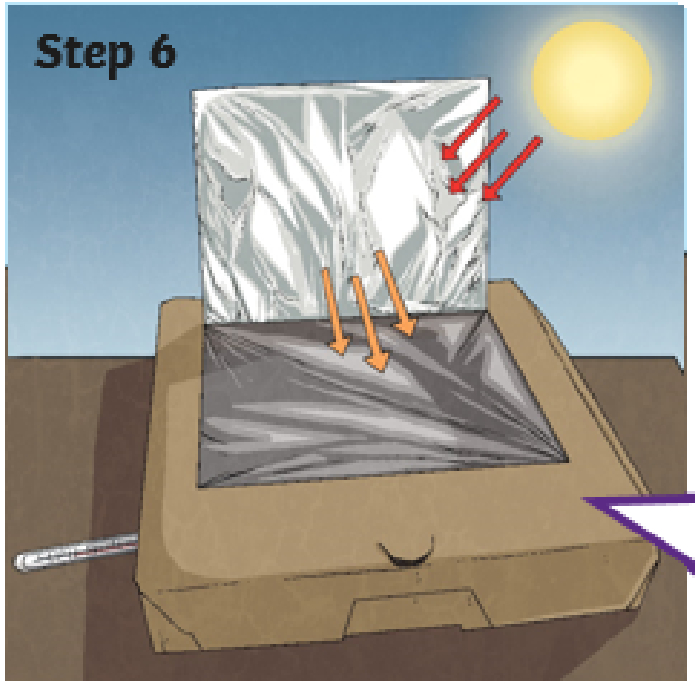
Her other inventions include a solar-powered **desalination machine** (which uses solar energy to remove salt from water at sea). This saved the lives of many people stranded at sea.

There are many schools named after her today, especially in the USA where she worked for many years.

Her work in solar energy is so well known that she is sometimes called the Sun Queen.

Solar Ovens

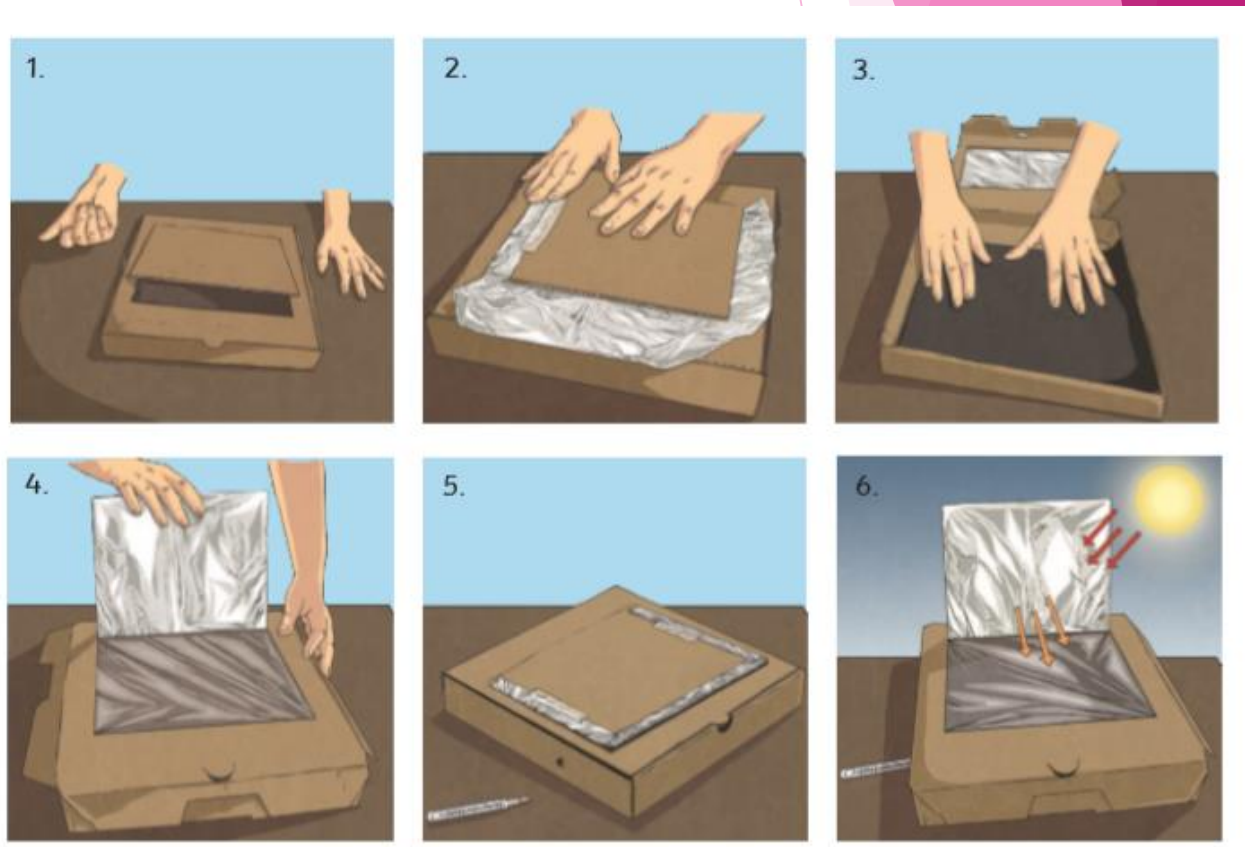
We are going to make and test a solar oven to see how even a simple device can amplify the heat from the sun.



Leave the box in the sunshine with the flap propped open to let light inside and watch to see the temperature go up on your thermometer.

Solar Oven Instructions

1. Cut a large flap in the top of your box which can be opened like an oven door.
2. Line the inside of the flap with foil, using glue to keep it all in place.
3. Cover the inside of your oven with black card, especially the bottom.
4. Cover the hole underneath your flap with cling film and tape it into place – you are trying to seal the box as much as you can with this step.
5. Poke a small hole into the side of your box, just big enough for the end of your thermometer to sit inside.
6. Leave the box in the sunshine with the flap propped open to let light inside and watch to see the temperature go up on your thermometer.



Share and Review

What was the hottest temperature your oven reached!

Our oven is very simple, but does show how energy from the sun can be harnessed for power.

What are some advantages of using solar power over other types of fuel?

Discovering Oxyen

LO: I can explain how oxygen was discovered.

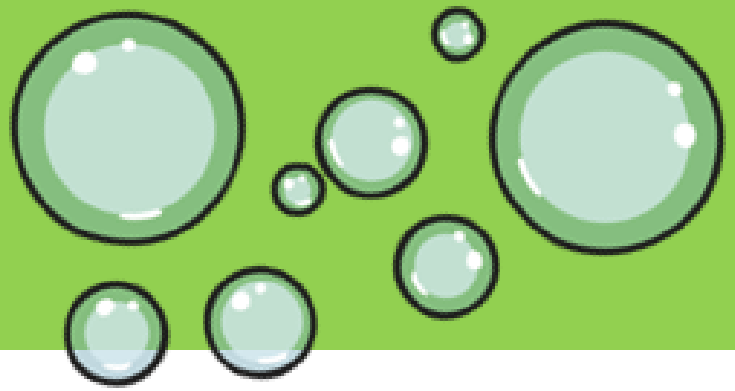
Success Criteria:

- I can describe the scientists who discovered oxygen.
- I can explain how the discovery of oxygen changed scientific ideas.
- I can conduct an experiment to demonstrate oxygen's properties.

Oxygen

What is oxygen? What is it useful for?

Oxygen is a gas at room temperature. It is the third most common element and is needed by most forms of life on Earth. Animals and plants take in oxygen for respiration. Oxygen makes up around 21% of the air around us.



Who Discovered Oxygen?

Two scientists were mainly responsible for the discovery of oxygen: Antoine Lavoisier and Joseph Priestley.

Antoine Lavoisier 1743-1794

Antoine Lavoisier was born into a wealthy French family. His father was a lawyer and Lavoisier inherited a large fortune at the age of five when his mother died. He was very interested in science at school and although he received a law degree, he never became a lawyer. Instead, he worked in various government jobs and was elected to the Royal Academy of Science in 1764. In 1775, he set up a laboratory in Paris where he could conduct experiments. It was in this lab that Lavoisier made many of his important discoveries to do with chemistry.

Who Discovered Oxygen?

Two scientists were mainly responsible for the discovery of oxygen: Antoine Lavoisier and Joseph Priestley.

Joseph Priestley 1733-1804

Joseph Priestley was an English chemist and theologian (someone who studies God and religion). He was born in Yorkshire and was the eldest of six children. From the age of one, he lived with his grandfather and then his aunt and uncle. He attended the best local schools. In 1755, he became a religious minister in Suffolk. He became interested in the sciences and conducted experiments while he was working as a minister. Between 1767 and 1770, he presented five papers to the Royal Society explaining his experiments. In the 1770s, he began his experiments into what he called 'different airs' and this is when he made most of his discoveries.

Here are some facts about the two scientists. Can you match up the fact to the correct person?

His mother died when he was just five years old.	He was chosen to be a member of the Royal Academy of Science.
He worked as a minister.	He had five brothers and sisters.
He set up his own laboratory to conduct important experiments.	He conducted a series of experiments into 'different airs'.

Phlogiston Theory

In the 1700s, scientists believed in a theory called the 'phlogiston theory'. They thought that flammable objects contained a substance called phlogiston that caused the objects to burn. The theory also stated that when objects burned, the phlogiston inside them left the object, so the object should become lighter.

However, experiments showed that actually, some objects gain mass when they burn, becoming slightly heavier. Phlogiston theory could not explain this.

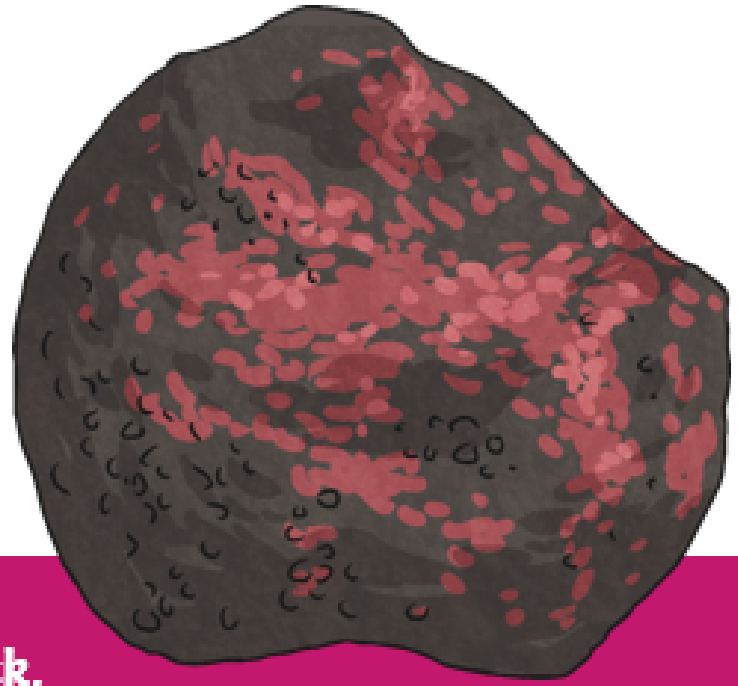
It was not until Antoine Lavoisier's work that the problems of phlogiston theory were solved.

Discovering Oxygen

In 1774, Joseph Priestley conducted his most famous experiment. He used a large glass lens to focus a ray of sunlight onto a piece of mercury calx (we now know this as mercury oxide) in a glass container.

The mercury calx emitted a gas that was captured in the glass jar. When tested, this gas caused a flame to burn intensely. Priestley breathed some of this gas in, and reported that it made his chest feel 'light and easy'.

He called the gas he discovered 'dephlogisticated air'.



Mercury calx, or oxide, looks like a red rock.

Discovering Oxygen

Priestley met Lavoisier on a trip to France. He told Lavoisier about his experiments and the gas he had discovered.

Lavoisier used this information as the basis for his own experiments and ideas. His work would finally disprove the phlogiston theory.

He found that when objects burn, they do not lose phlogiston, they actually combine with the gas that Priestley had discovered. Lavoisier realised that phlogiston simply did not exist!

He called the gas oxygen.

Priestley's and Lavoisier's work changed scientific ideas forever.

Ask your parents to light a candle and place a jar over the top. What happens?

Oxygen and Burning

We now know that oxygen combines with a fuel to burn. Objects cannot burn without oxygen.

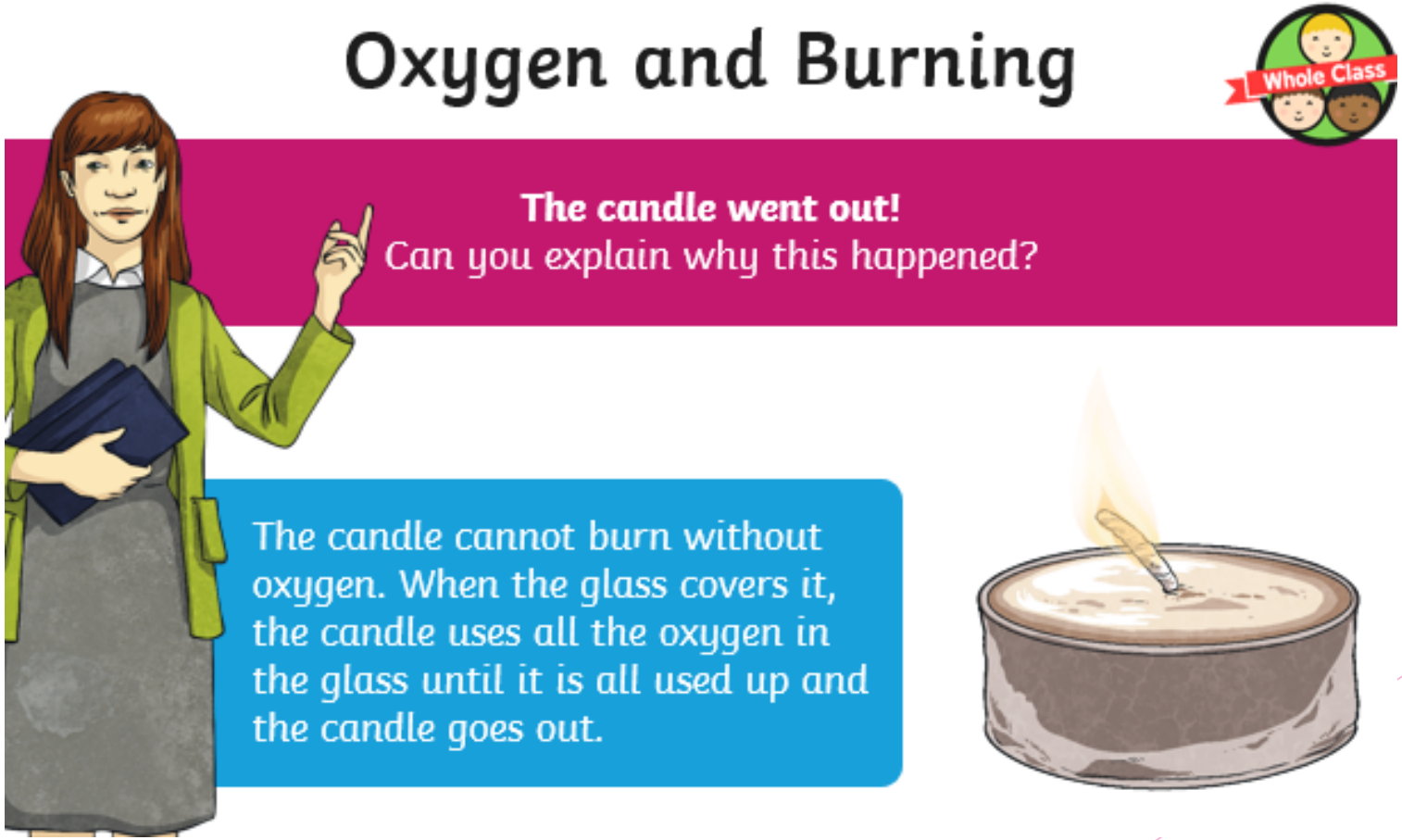
You will conduct a mini investigation similar to Priestley's experiment to prove that objects need oxygen to burn.

Watch your teacher light a candle and place a glass over it.

What do you think will happen?

Do it again and time how long it takes for the flame to go out! In your books, write an explanation of what has happened.

Oxygen and Burning



Thomas Edison

LO: I can describe how Thomas Edison's inventions changed people's lives.

Success Criteria:

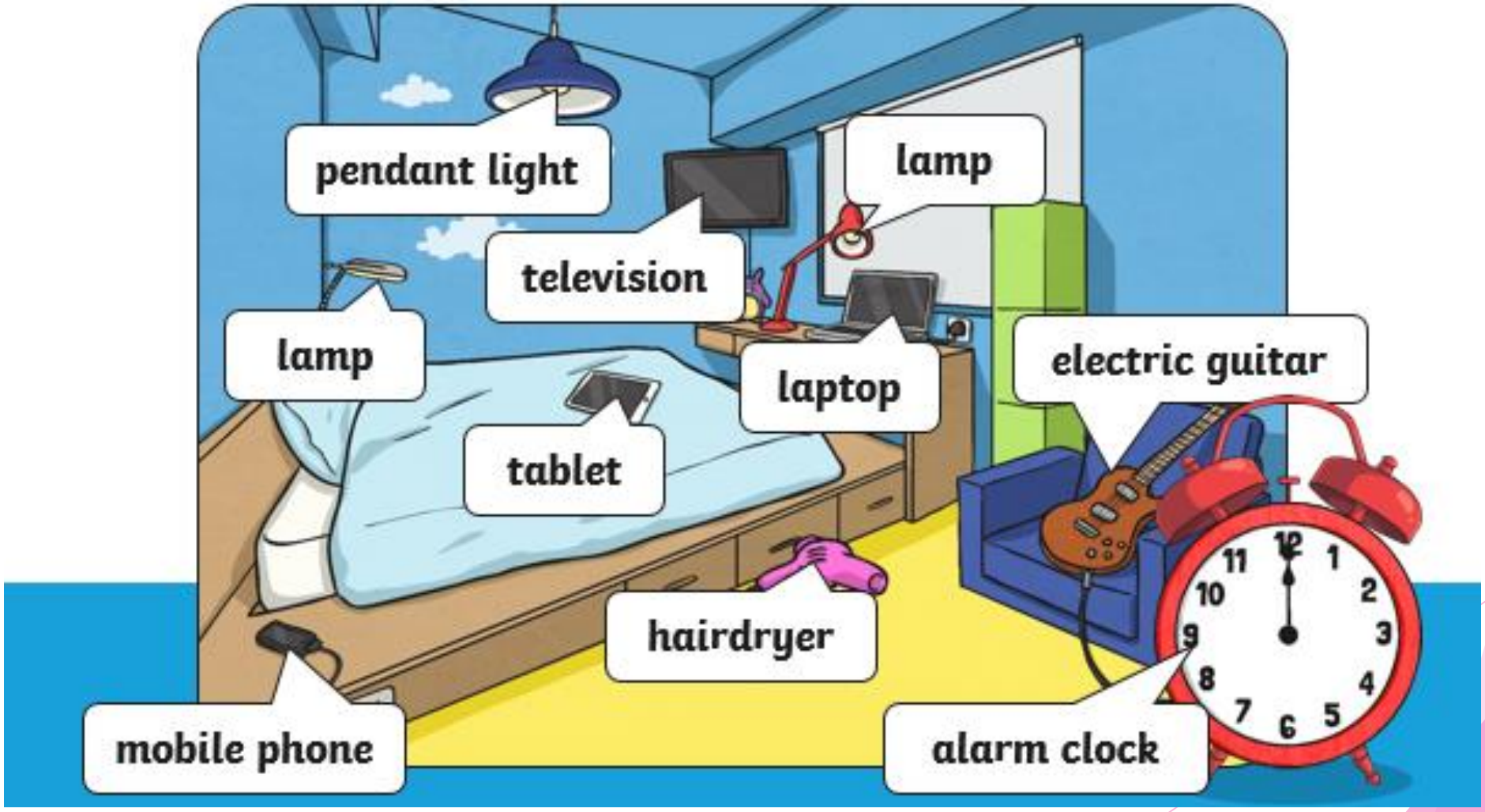
- I can identify appliances that run on electricity.
- I can describe what Thomas Edison invented.
- I can explain how his inventions changed people's lives.

Electrical Appliances

Can you identify all the electrical appliances in this room?

Electrical Appliances

How many electrical appliances did you spot?



What If?

What if there was no electricity?
Discuss this question with your partner.

Though many scientists contributed to the discovery of electricity and the invention of electrical items, one scientist in particular made it possible for people like us to enjoy the benefits of electricity in our homes. That scientist was **Thomas Edison**.

Thomas Edison

Thomas Edison was born in 1847 and died in 1931.

He was an American inventor and businessman.

Thomas didn't settle into school well because he was very easily distracted. He was too much of a daydreamer and was often in trouble with his teacher. After three months, his mother decided to homeschool him instead.

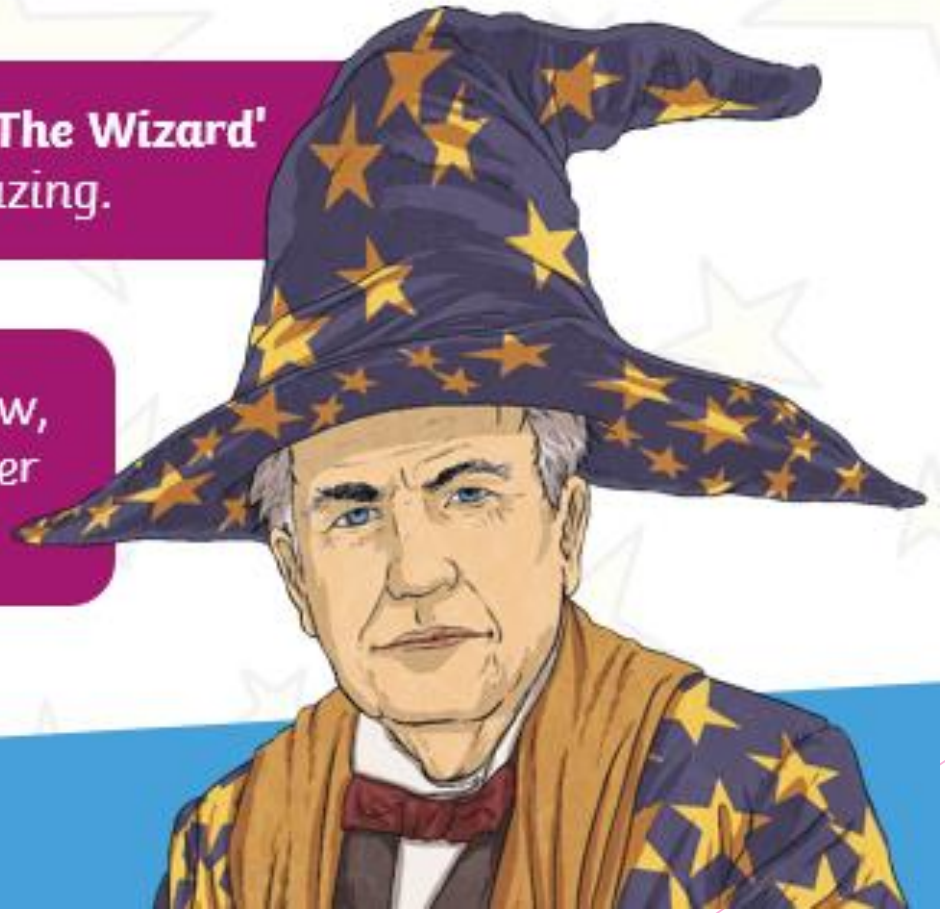
At the age of twelve, Thomas began to work on a train, selling newspapers and snacks. He loved doing experiments and even conducted some while at work!

Thomas Edison

Edison made his first invention when he was 22.

Later in his life, he was known as **'The Wizard'** because his inventions were so amazing.

Many of his inventions were not new, but he developed and improved other people's inventions.



Edison and Electricity

Edison's most famous invention was the light bulb. However, he did not actually invent it!

The light bulb had already been invented, but it burnt out quickly and could not provide light for very long, so it was not very useful.

Edison created a new light bulb that would stay lit for a long time, so that people could benefit from it.

Edison and Electricity

He also invented a carbon microphone for Alexander Graham Bell's telephone, which meant that conversations over the telephone could be heard much better.

Edison made what many consider to be his greatest achievement in the early 1880s. He introduced the world's first truly useful electric distribution system, which could distribute electric light, heat and power.

This invention made it possible for electricity to be used in people's homes for the first time and changed the world forever.

Hunt around your home and make a list of every electrical item you can find! Create a table in your book (a bit like the one below) and write what it would be like at home without electricity.

Electrical Item	What If There Was No Electricity in School?
Lights	**We would find it hard to see without the lights, especially on a dark day.**

Toothpaste

LO: I can investigate the invention of toothpaste.

Success Criteria

- I can describe the invention of toothpaste.
- I can make my own toothpaste and explain its properties.
- I can compare the effectiveness of different toothpastes.

Adult Guidance – Testing Toothpaste

In the Testing Toothpaste investigation, children will set up a comparative investigation to compare their own toothpaste with real brands of toothpaste.

You will need to prepare some resources before the lesson to set up the investigation.

In order to test the toothpastes, children will apply each toothpaste to a toothbrush and use the toothbrush to scrub a stain off an unglazed ceramic tile. For each pair of children, you will need to prepare a tile with four equal-sized stains. Marker pen is ideal for making the stains on the tiles. This should be prepared prior to the lesson so that children can get on with the investigation quickly and easily.

Children will decide on their method of measuring how effective each toothpaste is. Two ideas are suggested: scrubbing each stain five times then describing how it looks, or counting how many brushes it takes to remove each stain completely. You may wish children to take photographs of the stains for comparison after they have brushed them.

What Do You Really Know about Toothpaste?

We brush our teeth everyday, but how much do you really know about the toothpaste that you put on to your toothbrush?

The most popular toothpaste flavour is vanilla.

Toothpaste should not be swallowed.

Toothpaste contains abrasives (rough particles) to grind away plaque.

Toothpaste contains soap to make it produce foam as you brush.

Fluoride is a mineral found in many toothpastes that reduces tooth decay.

Look at these statements about toothpaste and decide if each one is a fact or if it is fiction.

What Were the First Toothpastes Like?

The first known toothpaste was invented in North Africa by the Ancient Egyptians as early as 5000 BC, although historians don't think they used brushes until 3500 BC (when they made brushes from twigs). They may have used the toothpaste on its own or rubbed it on to their teeth with rags.

Chinese people were the first people to use a toothbrush we would recognise today, with bristles attached to bamboo or bone. They even invented 'chewing sticks' made from sweet-smelling woods and leaves to freshen their breath.

Washington Sheffield

Washington Sheffield was an American dentist and he was famous for inventing the first modern toothpaste in a tube.

He was also considered to be one of the most skilful dentists in the USA.

Dr Sheffield formulated his own tooth powder to use on his patients.

In the mid-1870s he created a ready-made 'Tooth Crème', which included mint flavourings. This was very popular with his patients, who requested samples to use at home.

Dr Sheffield began to make and sell his tooth crème. So many people wanted to buy it that he had to build a laboratory and factory behind his house!

He set up a manufacturing company with his son, who was also a dentist.

Washington Sheffield

In 1880, Dr Sheffield and his son started producing a new product.

They called this product **'Dr Sheffield's Crème Angelique Dentifrice'**.

This was the first toothpaste as we know it today and it was sold in tubes like modern toothpastes.

In 1896, Colgate and Company created a toothpaste called 'Dental Cream', which was sold in tubes imitating Dr Sheffield's design.

His invention was so successful that it was the basis for all the modern toothpastes we use today.

Create Your Own Toothpaste

You are going to invent your own toothpaste,
just like Washington Sheffield.

On your **Toothpaste Invention Activity Sheet**, you will find the ingredients you will need for your toothpaste.

It is up to you how much of each ingredient you put into your toothpaste, with a maximum of one teaspoon of each ingredient.

When choosing how much of each thing to add, think about the properties of a good toothpaste. What should it smell like? What consistency should it have? How will it remove stains and plaque? Choose ingredients to give your toothpaste the properties it needs.

Use these ingredients to invent your own toothpaste. You can decide how much of each ingredient to put in, up to a maximum of one teaspoon of each ingredient. Keep a record of your recipe by completing the table to show your chosen amount of each ingredient.

Ingredients	**Amount**
bicarbonate of soda	
cornflour	
salt	
glycerine	
peppermint essence	
water	

Method:

- Mix the bicarbonate of soda, cornflour and salt together in a beaker.
- Add the glycerine and the peppermint essence.
- Add water until you think your toothpaste is the correct consistency.

You will test your toothpaste to see how effective it is at removing stains, and compare it to real brands of toothpaste.

Remember that your toothpaste is a fun invention and should not really be used on your own teeth or anyone else's!

Test your invented toothpaste against real brands of toothpaste. Which one will clean the best?

You will place the same amount of each toothpaste on to the same type of toothbrush, then use each toothpaste to brush a stain off a tile.

How will you measure how effective each toothpaste is at cleaning the stain off?

☐ Brush each stain five times, then record how well each stain was cleaned off.

☐ Count how many brushes it takes to clean the stain off.

List the toothpastes you will compare:

_____

Which toothpaste do you predict will be the best at cleaning the stain off?

_____

Now, carry out your investigation and gather your results.

The way your results look will depend on which method you have chosen. Choose the table which matches your method, and complete it with your results.

1.

Toothpaste	**Description of the Stain after Brushing Five Times**