

A shield-shaped logo with a light blue and yellow background. It features a microscope on the left, a pi symbol in the center, and gears at the bottom. The word 'STEM' is written across the top in large, colorful letters: S (green), T (blue), E (orange), and M (yellow).

**S T E M**

**Science, Technology,  
Engineering and  
Mathematics**

# STEM: Electric circuits

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We are surrounded by technology and innovation.

Electricity is one of the greatest technological innovations of mankind.

Scientists and inventors have worked to decipher the principles of electricity since the 1600s.

# STEM: Electric circuits



## The history of electricity

**600 BC**  
This is when historians believe electricity was first discovered by a mathematician called Thales of Miletus. He is said to have noticed that polishing a piece of amber with wool created a static charge, which attracted objects, like feathers. He was the first person to record his findings.

**1729**  
A ground-breaking discovery is made that electricity is not just generated from rubbing materials together but that some materials carry electrical charges called 'conductors' and some don't ('non-conductors').

**1600**  
An English scientist, William Gilbert, first coined the word 'electricity' from the Greek word for amber: *elektron*.

**1780-1850**  
The Industrial Revolution takes place and production processes shift from hand-based technology to machines. Driving these huge changes was the steam engine, which became the main source of power in industry.

**1837**  
The first commercial electric motor (below) was unveiled by Thomas Davenport.

**1881**  
The small town of Goddington in Surrey attracted worldwide attention for becoming the first to install a public electricity supply. It did this via a mile's waterwheel on the local river, the Wey.

**1884**  
The modern steam turbine – which converts the thermal energy in steam into mechanical energy and, in turn, into electrical energy – is invented by Sir Charles Parsons. This led to cheaper, more abundant electricity and helped to advance marine transport and naval warfare.

**1800**  
The first electric light is invented by English scientist Humphry Davy, which is followed by Thomas Edison's more famous invention of the first commercially viable light bulb – which went mainstream – in 1875.

**1868**  
The first power station is designed and built by Lord Armstrong. He pioneered the use of hydroelectricity to power and heat his own house. You can visit this historic house today in Northamptonshire.

**1879**  
For the first time, a utility company begins to sell electricity from its power station in San Francisco to customers via electric power transmission lines. This heralded a new era of bulk transfer of electrical energy.

**1882**  
The first electrical railway is constructed, purely for pleasure, on Brighton, southeast. It's still in operation today.

**LATE 1880s**  
The 'War of the Currents' takes place when Thomas Edison and Nikola Tesla clashed over which type of electricity supply was best. Edison argued for 'DC' (direct current), while Tesla advocated 'AC' (alternating current). Tesla won, but DC technology is still used for some devices.

**1886**  
The first conversion substation was invented and enabled high AC voltages to be converted into manageable sizes, via a 'transformer', so electricity could be safely transmitted into homes.

**1895**  
Scientists Albert Einstein (above) discovers the science behind photoelectric cells – the technology used in solar panels – when he shows that light can produce electricity.

**1897**  
Wind turbines are used to produce electricity for the first time.

**1925**  
Scottish inventor, John Logie Baird, gives a demonstration of the first televised images. He went on to achieve breakthroughs in the distance over which these electrical images could be transmitted. In 1928, he introduced the first commercially made television set (but in the UK).

**1926**  
Work starts on the National Grid so electricity can be made available to everyone easily and cheaply. By 1933, over 10 million British people have electricity at home.

**1928**  
The first British pylons are erected, near Fifehead Keye in Dorset. It takes another five years to pull up the remaining 26,000 over the UK.

**1939-1945**  
During World War II, electricity was a threat, as light allowed the enemy to identify places to bomb. Street lights were switched off during blackouts, and cars and traffic lights were fitted with shutters, which led to an increase in road accidents.

**1951**  
A power station in Idaho produces electricity from a nuclear reactor. This marked the start of nuclear power, or atomic power as it was then known.

**1956**  
The first nuclear power station to generate energy on an industrial scale opens at Calder Hall in Cumbria.

**1957**  
Energy production is so compromised following World War II that US residents turn to solar power in their droves.

**1974**  
The computer is born. It is called the 'Altair' (below) but it isn't until a few years later that the 'PC' goes mainstream led by Apple, Tandy and Commodore.

**1977**  
Our reliance on electricity is demonstrated when New York City endures a massive blackout. People are stranded on subways, commuters sleep at work, travellers are stuck at airports and savings plants malfunction.

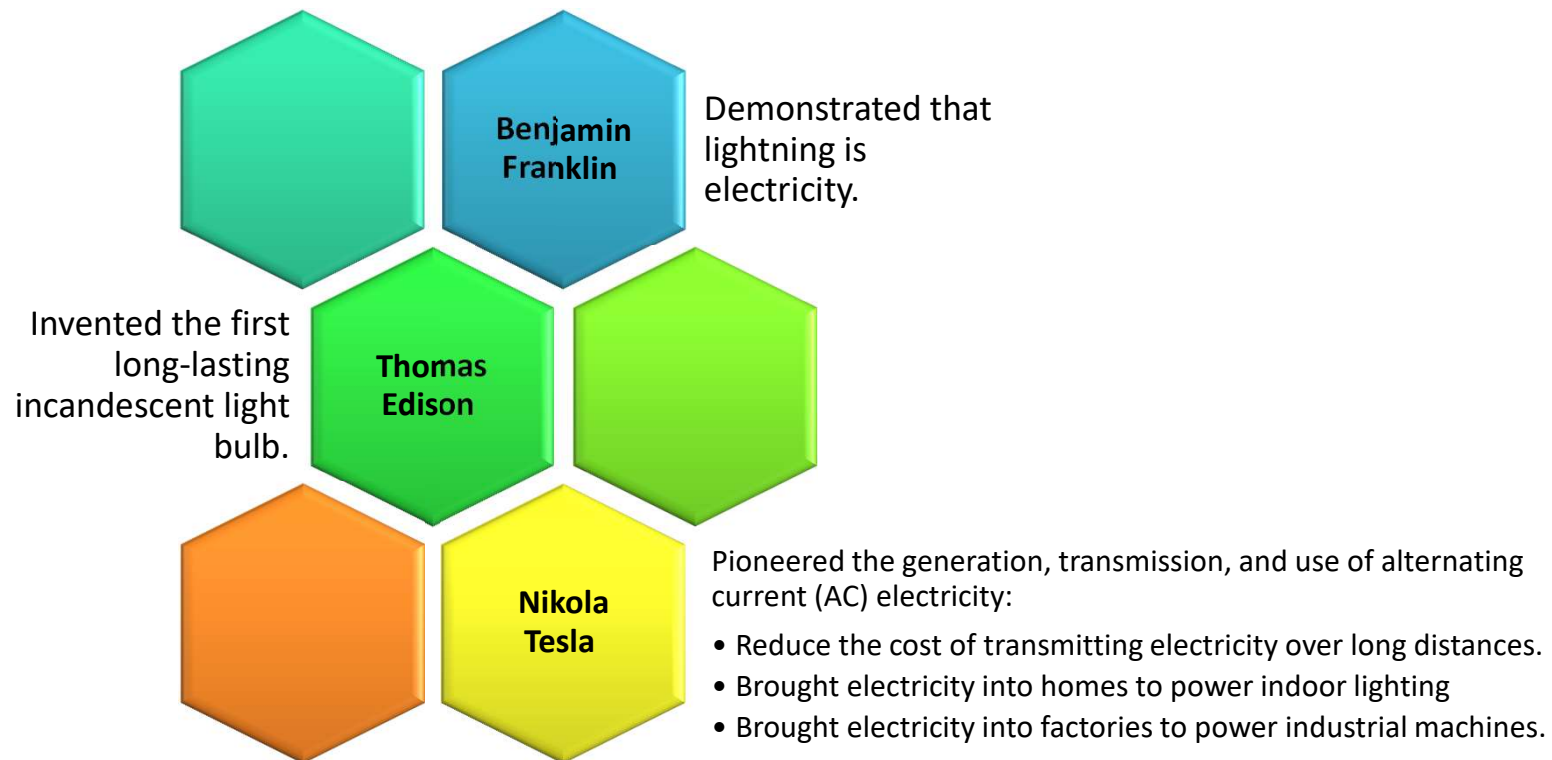
**2003**  
Electricity consumption from consumer electronics – like tablets, mobile phones and computers – has risen by 377% since 1974.

**2008**  
The Climate Change Act becomes law and the UK Government pledges to cut carbon dioxide (CO<sub>2</sub>) emissions by 80% by 2050.

**2013**  
Electricity consumption from consumer electronics – like tablets, mobile phones and computers – has risen by 377% since 1974.

**EDUCATION**  
Inspiring the next generation

# STEM: Electric circuits



# STEM: Electric circuits



## 1<sup>st</sup> Experiment – Conductive dough

### Materials:

- 230 g water
- 150 g salt
- 1 table spoon vegetable oil
- 160 g flour
- table spoons of cream of tartar
- food coloring



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## 2<sup>nd</sup> Experiment – Spooky electric circuits

### Materials:

- Conductive dough of different colors
- Electric wires
- Battery 9 V
- LED's



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## 3<sup>rd</sup> Experiment – Electric messages

### Materials:

- LED's (or buzzer)
- Electric wires
- Battery
- Switch
- Paper and pencil



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## 4<sup>th</sup> Experiment – Mini aspirator

### Materials:

- Plastic bottles of 1,5 L and 0,5L
- Hot glue
- Welding iron
- Cutter X-ato
- Empty milk package 1L
- Scissors
- Pencil
- Electric motor
- Connecting wires
- 1.5V batteries and stand
- Adhesive tape
- Card
- Flexible tube, about 30 cm
- Ruler





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## The science behind it...

- Electricity
- Circuit
- Conductor and insulator
- Battery and it's polarity
- Current
- Voltage
- Resistance
- Short circuit

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## The science behind it...

### 1<sup>st</sup> Experiment

Students learn what makes a substance conductive on a chemical level. With some creativity, experimentation, and research, different materials can be used to construct circuits.

### 2<sup>nd</sup> Experiment

Playdough is not extremely conductive and is malleable, allowing students to make a big range of circuits without worrying about including additional components.

### 3<sup>rd</sup> Experiment

Students can discover electric message systems, like International Morse Code

### 4<sup>th</sup> Experiment

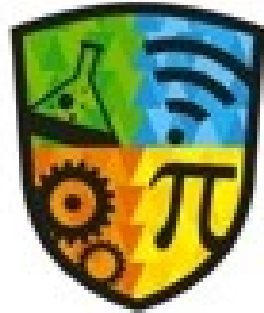
Students make a small vacuum cleaner using their electric circuits knowledge. The experiment also allows them to learn how vacuum and atmospheric pressure work.

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***Inspiramos hoje os líderes de amanhã!***

*Inspire today the leaders for tomorrow!*